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ABSTRACT

Provided are the appendixes to the final report of the Leadership Training Institute (LTI) in Learning Disabilities at the University of Arizona. Sections cover the following areas: (1) reports of LTI meetings and conferences; (2) contracted papers on research in the field of learning disabilities (such as "Neurological Factors in Learning Disabilities" by M. Denckla and "Summaries of the Research on the Revised Illinois Test of Psycholinguistic Abilities" by S. Kirk); (3) summaries of research; and (4) information lists (such as data from publishing companies, surveys of materials and problems, and a selected bibliography on traditional treatments of learning disabilities). (IM)

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FINAL REPORT

VOLUME II

U. S. O. E. Contract

LEADERSHIP TRAINING INSTITUTE
IN
LEARNING DISABILITIES

N. Dale Bryant, Director

Corrine E. Kass, Associate Director

Sponsored By

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University of Arizona
George Leshin, Head

and

Program Development Branch, Division of Educational Service
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EC100651

PREFACE

The appendices contained herein are assembled in a volume (II) separate from the body of the report (Volume I) as an aid to ease of reading the various sections. These appendices are lettered consecutively and can be utilized in conjunction with Volume I as reference is made to each. The papers which appear in this volume are (a) reports of LTI meetings and conferences, (b) contracted papers from the field, (c) summaries of research, and (d) information lists.

The University of Arizona Leadership Training Institute in Learning Disabilities (LTI) prepared this report under a grant from the Division of Educational Services, Bureau of Education for the Handicapped, U.S. Office of Education (Grant #OEG-0-71-4425 604, Project #127145). The overall purpose of the LTI was to make a statement about the direction in which the field of learning disabilities is moving. Specific information was solicited from the field for inclusion in such a statement. Much of the information was complete in itself and, rather than paraphrasing such input, the appendices in this volume contain intact products.

The "state of the art" in learning disabilities is presented through these separate contributions in Volume II as well as through the composite report of Volume I. The contracted papers reflect points of views from other disciplines, and a Seminar of Scholars held by the LTI resulted in a set of proceedings which reveals the points of agreement among a number of leadership personnel on the status currently noted in the young immature art of learning disabilities.

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CONTENTS

I. Appendices of Meetings and Activities Sponsored by the LTI, 1971-72

Appendix A: Summary of Consultants' Papers 1
by N. Dale Bryant with Rena Lewis

Appendix B: Report on the Planning Meeting 9
by N. Dale Bryant with Rena Lewis

Appendix C: Report on the Conference of State Child Service Demonstration Programs 15
by J. Lee Wiederholt with Rena Lewis

Appendix D: Report on the Conference of Teacher Trainers . . . 23
by J. Lee Wiederholt with Rena Lewis

Appendix E: Script of the LTI's Slide Presentation to DCLD at the March 1972 CEC Conference 47
by Corrine E. Kass with Rena Lewis and Marilyn Johnson

Appendix F: Report on the Meeting of DCLD at the March 1972 CEC Conference 53
by Rena Lewis

Appendix G: Report on the Seminar of Scholars. 57
by Rena Lewis

II. Appendices of Subject Variables: Definition, Incidence, Characteristics, and Correlates

Appendix H: Neurological Factors in Learning Disabilities: A Review of the Nature of Present Contributions of Neurology and Appraisal of Future Research Needs from a Neurologist's Point of View 217
by Martha Bridge Denckla

Appendix I: Summaries of the Research on the Revised Illinois Test of Psycholinguistic Abilities. . . . 229
by Samuel A. Kirk

Appendix J: Brain-Behavior Relationships and Learning Disabilities 279
by Homer B. C. Reed, Jr.

Appendix K: An Information-Integration Theory and its Application to Normal Reading Acquisition and Reading Disability 303
by Gerald M. Senf

Appendix L: The Application of Bayes' Theorem to Clinical Identification of Learning Disabilities. 393
by John F. Wissink and Corrine E. Kass

III. Appendices of Personnel Training Practices in Learning Disabilities

Appendix M: Report of the University of Arizona Student Task Force 415
by James A. McLoughlin, Chairman

Appendix N: A System of Objectives Based on Bloom's Taxonomy (Cognitive Domain) Applied to Personnel Preparation in Learning Disabilities. 423
by Corrine E. Kass

Appendix O: Learning-Disability Teacher Certification in the Fifty States 431
by Robert L. Minniear

IV. Appendices of Methods and Materials in Learning Disabilities

Appendix P: Selected Bibliography on Traditional Treatments. . 443
by Corrine E. Kass with Ernest Archambault

Appendix Q: Data from publishing Companies 451
by Marsha Schubert

Appendix R: Data from DCLD Survey of Materials 481
by Rena Lewis

Appendix S: Data from DCLD Survey of Problems. 531
by Rena Lewis

APPENDIX A

SUMMARY OF CONSULTANTS' PAPERS

N. Dale Bryant

with

Rena Lewis

August 1972

INTRODUCTION

In the summer of 1971, several leaders in the field of learning disabilities were asked to respond to the proposed goals of the Leadership Training Institute in Learning Disabilities (LTI).

A partial text of the letter to consultants in presented below:

> We are engaged in a Leadership Training Institute aimed at surveying and analyzing the field of learning disabilities. We hope to involve outstanding leaders in the field so that the project will benefit from their advice and review of project reports. We hope that you will be one of the members of this advisory board.
>
> Initially, we are asking the members to write a paper responding to the goals and questions listed below. From the letters we receive, we will obtain initial guidance for the project. In addition, the letters will provide one basis for planning Winter or Spring meetings with some members either individually or in groups at Tucson or on the member's home grounds. Letters will also aid us in contracting for specific papers. Your letter will not represent a commitment for further work, so even if you do not wish to attend meetings, prepare later papers, or review project reports, we hope you will still put down your thinking in the letter we mentioned.
>
> Three of the goals of this project are listed below:
>
> 1. The first goal of the project will be the preparation of a document summarizing present knowledge and services in learning disabilities, and outlining needed research.
>
> 2. A second goal will be the preparation of a second paper summarizing present training activities in learning disabilities, including present personnel distribution, and recommending cost-effective factors in manpower training needs for an adequate nationwide program.
>
> 3. A third goal will be to produce a plan for implementing strategies in research, training, and services. The plan will utilize input from objectives one and two and will give consideration to the total educational endeavor.

We would like the following plus any other thoughts you can share with us:

1. Your overall reaction to each of these general objectives and suggestions for sources of needed information (e.g., surveys, critical reviews, theoretical models, collections of reports, individuals who are knowledgeable or creative thinkers in these areas, etc.)

2. For each goal, state your opinions just as if you were writing a summary of the documents as you think they should be written.

Nine consultants responded. These were:

Dr. Howard Adelman	Dr. Howard McGrady
Dr. Hyman Gardsbane	Dr. John McLeod
Dr. Donald Hammill	Dr. Margaret Scheffelin
Dr. Eleanore Kenney	Dr. Charles Strother
Dr. Jeanne McCarthy	

The purpose of this paper is to summarize the recommendations made by the consultants. First, the comments of the consultants on the role of the LTI will be presented. Second, their viewpoints on priorities and needs in the field of learning disabilities will be outlined.

CONSULTANTS' COMMENTS ON THE ROLE OF THE LTI

The consultants expressed recognition of the need for an effort such as the LTI. Dr. Donald Hammill wrote, "Your project certainly is ambitious, multifaceted, and needed at this period of time in our professional development." Dr. Jeanne McCarthy concurred that, "Your project must rate a high priority, because of the potential for national impact on the total field." Dr. Howard Adelman stated, "It seems imperative to have the personnel, resources, time and funding commitment to accomplish these tasks."

The consultants expressed concern over the broad scope of the work of the LTI. Dr. Adelman suggested that the LTI might modify its goals and initially direct its attention to problems of general education and then to the modifications necessary for special education. Dr. Harold McGrady commented, "This year must be considered a beginning--a year to stimulate a method for institutional, on-going research in learning disabilities. The broad goals established for this initial LTI cannot possibly be met."

The consultants suggested that the LTI adopt a multidisciplinary approach towards its goals. Dr. Adelman strongly suggested looking to individuals in addition to those who are associated with special education: "The project should not contribute further to the erroneous impression that the concerns of general and special education (and of the various areas of special education) are mutually exclusive and/or substantively different." Dr. McGrady suggested that the LTI sponsor a task force to explore the effect of other disciplines on the field of learning disabilities. Dr. McCarthy pointed out the necessity of surveying not only special education training programs for learning-disability personnel but also "training programs in Departments of Speech, Physical Education, Reading, Elementary Education, Counseling, etc., since LD seems to cross departmental lines." Dr. Hyman Gardsbane expressed the need to consider regular education in the LTI scope.

The consultants made recommendations concerning legislation and funding by the federal government. Dr. Gardsbane commented, "A plan for implementing strategies in research, training, and services should probably include recommendations for legislative changes and changes in federal funding procedures." Dr. McGrady saw the possibility of improving research by recommending "A National Institute for Research in Learning Disabilities. Following the pattern of NIH, which has special institutes on cancer, stroke, etc., a NIRLD could be a vital, continuing force." Dr. McCarthy commented on recommendations to be made by the LTI: "If BEH will fund the specific programmatic research found to be needed, and if others will follow through on priority research areas, perhaps some action will follow from your efforts."

The consultants had many suggestions concerning the products of the LTI. Dr. John McLeod felt that the LTI might devise a common code system for retrieval systems throughout the country. Dr. Margaret Scheffelin suggested the inclusion of a glossary of terms concerning learning disabilities. She also suggested that the documents be translated into different languages and be visual and pictorial as well as verbal. Dr. McCarthy thought that the LTI should consider making self-contained, in-service training packets for use by different groups, e.g., parents, college students, teachers, etc.

The consultants commented upon procedures that could be used by the LTI. Dr. McGrady stressed the need for a "think tank" process with consultants to analyze the gathered information and to add to it from different fields.

CONSULTANTS' COMMENTS ON PRIORITIES AND NEEDS IN THE FIELD OF LEARNING DISABILITIES

The consultants felt LD problems should be approached within the context of general education. The problems facing all of education should be examined first, and then the implication of these problems for special education and learning disabilities in particular should be considered. This approach would avoid unnecessary duplication of efforts. Dr. Eleanore Kenney made the point that not only is learning disabilities best understood in relationship to the total field of regular, special, and preschool education, but also that learning-disability concepts and practices can contribute to the many questions being asked in both regular and special education. Dr. McCarthy stated that learning disabilities and special education are being asked to solve many problems that perhaps are more appropriately the responsibility of regular education. She commented that special education must emphasize that its role is one of support to regular education. Dr. Adelman felt that learning disabilities should be approached within the context of formal education in general. Dr. Adelman would prefer that we examine the role, nature, and scope of formal education and then determine how special education fits within this broader framework.

A number of consultants felt it is essential to maintain a multidisciplinary attitude toward learning disabilities. This attitude is in keeping with the history of the field of learning disabilities and encourages communication from all fields that can contribute to learning disabilities. For example, Dr. McGrady expressed the need to bring in individuals from other fields to contribute to a comprehensive theory of learning disabilities. Dr. Charles Strother pointed out not only the need for the contributions of other fields to learning disabilities but also the contribution that learning disabilities can make to other fields. He stressed that the management of learning disabilities is an association among three social systems: a child-care system, a health-care system, and an education system. Most of the consultants felt that learning disabilities should be considered within the broader framework of special education as it relates to general education. There must be a continual exchange between fields that can contribute to understanding and helping learning-disability children. Most consultants stressed the need for theoretical frameworks in learning disabilities which incorporate the contributions from many fields.

The consultants identified the problems of definition and prevalence as top priority concerns. Dr. McCarthy noted that the problem of definition is the most important issue in the field. She stated that the incidence question is causing difficulty at the present time. She cited a 1970 school staffing survey of 79,000 schools in which incidence reports were influenced by the availability of service. Dr. Scheffelin supported this concern over the definition. She encouraged the gradual removal of neurological terminology from the working lexicon of learning disabilities. The exclusionary aspects of the definition of learning disabilities were also a concern to Dr. Scheffelin. Dr. McCarthy shared this opinion, particularly in regard to the relationship of learning disabilities to the culturally deprived. Dr. Adelman felt it was essential to include an analysis of the learning environment in our definition of and distinctions between learning disabled, emotionally disturbed, and educationally handicapped.

Consultants were critical of and concerned about diagnostic and evaluative procedures. Many consultants were disenchanted with current diagnostic procedures and seemed in favor of more informal methods. Dr. McLeod commented that diagnosis is more than assessment, and treatment is more than placement. Dr. McLeod outlined a four-stage diagnostic model which utilizes more educationally-based diagnosis to initiate immediate remediation and treatment. Dr. Scheffelin shared the concern of the other consultants, but stated that instruction is the teacher's main job, testing is not. She shared the discontent over assessment techniques and she felt that the usefulness of the assessment data should be reexamined. She presented an assessment scheme that includes an analysis both of response characteristics of the learner and of the response characteristics required for successful performance. Dr. Adelman stressed that evaluation must include both the child and the program in which he must perform.

The consultants voiced concern about service practices, particularly the use of materials of questionable effectiveness. Dr. McLeod suggested the development of computerized retrieval systems of materials. He also saw the need to come up with a commonly-accepted coding system for easy retrieval strategies and activities. Dr. Adelman saw the personalization of classroom instruction as a key step in both remediation and prevention of learning disabilities. Dr. McCarthy felt that fervor over the use of intelligence tests will be reduced by the individualization of instruction and clinical teaching. While the consultants urged that remedial methods must be evaluated, Dr. McGrady cautioned that evaluative techniques must consider the individuality of both methods and teachers. Dr. McGrady also suggested the need for a model of services flexible enough to allow administrators to select the service appropriate for the particular situation. In general, the consultants felt the need for more precise evaluation of service practices.

The consultants noted the trend toward providing services to both preschoolers and young adults. Dr. McCarthy saw an increase in the early identification of high-risk children. Dr. Scheffelin felt attention must be given both to preschoolers and to young adults. Dr. Kenney cited experiences of the Miriam Diagnostic Preschool in developing a multi-level community education program. She encouraged input to learning disabilities from people working in early childhood development.

The consultants felt parents should be included in the planning of treatment. Dr. Scheffelin advocated that strategies for parents to use with learning-disability children be devised. Referral procedures should be made available to parents.

The consultants expressed concern about administration of LD programs. Dr. McCarthy advised against expansion of self-contained classes or residential services for the learning-disability child. Dr. Gardsbane voiced concern about administration and funding problems of learning-disability programs. He encouraged flexibility in the Child Service Demonstration Programs in implementing programs appropriate for particular areas.

The consultants believed training practices should be scrutinized. Dr. Adelman listed four basic issues in training: what are the necessary prerequisite skills, what should be the content of the program, how can the content be taught effectively, and how should the impact of the program be evaluated? Dr. Gardsbane rated in-service training of regular classroom teachers in learning disabilities as important. He also saw a role for parent groups, both as advisors and educators. Dr. McLeod shared this concern over the training of regular classroom teachers. He discussed three levels of training: background in special education for all teachers, training of a special education generalist, and training of a special education specialist. Dr. Hammill advised the institution of non-categorical training programs to train resource personnel.

The consultants maintained that research practices must be examined. The data upon which service and training programs are based is scanty. There is need for new research methodologies appropriate to learning disabilities. The research findings of other fields must be capitalized upon. Dr. Hammill cited promising areas of research, such as efficacy studies comparing itinerant, self-contained, and resource room approaches; criterion referencing; and matching children's learning styles with appropriate materials. Dr. McGrady saw a need for research methodology appropriate to the study of individuals rather than groups which would objectify clinical judgment and intuition. Dr. Gardsbane listed areas of needed research: the trend towards open classrooms, motivational problems, and the effect of the attitude of the teacher towards the child with a learning disability. Dr. Kenney noted a number of research studies that can be applied to the education of learning-disability children, notably work by Cruickshank, Senf, Simms, and Rappaport. She encouraged the development of methods to translate the results of work such as this to practical teaching procedures. Dr. Scheffelin advocated that reporting of research be standardized. She repeated the research needs which she and Dr. James Chalfant described in the Task Force III Report:

1. Precise descriptions of specific observable behaviors related to dysfunctions in learning.
2. Procedures for recording these behaviors.
3. Procedures for educational assessment and diagnosis.
4. Prevalence and incidence.
5. Effective remedial or compensatory methods of intervention.
6. The efficient delivery of services to children.
7. Prevention.
8. The nature of learning.

APPENDIX B

REPORT ON THE PLANNING MEETING

October 7 - 9, 1971

N. Dale Bryant

with

Rena Lewis

August 1972

INTRODUCTION

In October 1971, the Leadership Training Institute in Learning Disabilities (LTI) invited a small number of consultants representing different viewpoints in the field of learning disabilities to discuss plans for the work of the year. Attending were four consultants: Drs. James Chalfant, Hyman Gardsbane, Frank Hewitt, and Homer Reed, plus a representative from the Bureau of Education for Handicapped, Mr. Lawrence Lieberman.

This meeting covered many topics. The scope of the LTI was presented to the consultants; the three major areas of work--technical assistance to the State Child Service Demonstration Programs, a survey of research and services, and a study of training--were outlined by the LTI staff and reactions were made by the consultants; and each consultant summarized his recommendations to the LTI.

This report shall summarize (1) general comments of the consultants, (2) comments on technical assistance, (3) recommendations concerning the study of research, and (4) recommendations concerning the study of training in the field of learning disabilities.

GENERAL COMMENTS OF THE CONSULTANTS

Scope of the Work of the LTI. Most of the consultants viewed the objectives of the LTI as valid goals, but quite ambitious for a one-year project.

The Issues of Definition and Evidence. The consultants concurred that the issues of definition and incidence pose crucial problems in the field of learning disabilities. These problems will affect the State programs, the study of research and services, and the study of training.

The consultants isolated three distinct populations currently defined as learning disabilities, each with a different estimate of prevalence. The first population includes only those underachieving children with proven or assumed neurological dysfunction. This "hard core" learning-disability group is estimated to be 1-3% of the school population. The second population includes all underachieving children not included in other categories of exceptionality. This "learning problem" group is thought to be at least 10% of the school population. The third population encompasses all children with difficulties in learning, including those children with other handicapping conditions, such as mental retardation and emotional disturbance. The emphasis in this last population is not on the labeling of children but on the use of the learning-disability body of knowledge as an approach, a way of dealing with any child in educational difficulties.

The consultants emphasized that the LTI must address itself to the problem of different definitions and prevalence estimates since different populations imply quite different research, training, and service strategies. Also, the study of definitions must consider the current trend toward decategorization. It was noted that the use of learning disabilities as an approach was becoming increasingly popular, and thus the field of learning disabilities has a potential for impact on both special and regular education. For this reason, the LTI should not restrict itself to the study of the field of learning disabilities but should also consider all phases of special and regular education.

COMMENTS ON TECHNICAL ASSISTANCE

The consultants stressed that the role of the LTI in relation to the federally-funded State Child Service Demonstration Programs should be one of an advocate, a helper, not an evaluator. The LTI should stimulate awareness of the need for technical assistance and respond to requests for technical assistance.

The consultants agreed that the State programs will need technical assistance in the area of evaluation. They expressed grave concern over the multiplication of demonstration programs required by the federal funding agencies. The consultants were apprehensive that demonstration programs would be multiplied before they were adequately evaluated and revised. Thus, they stressed the need for the LTI to assist the State programs in evaluation.

The consultants recommended site visits to the State programs in order to better assess their needs and understand their character. Some examples of questions that should be addressed to the State programs at this initial stage of development are:

1. How is the target population defined?
2. How is the target population identified? Screening, teacher referrals?
3. How is the target population assessed or evaluated?
4. What kinds of services are needed?
5. How can services be most effectively delivered?
6. What kinds of personnel are needed? How are these to be obtained?
7. What kinds of in-service programs are needed?
8. What kinds of staffing patterns should be used?
9. What kinds of administrative patterns are appropriate?

RECOMMENDATIONS CONCERNING THE STUDY OF RESEARCH

The consultants recommended that the LTI's study of research:

1. should not duplicate previous reviews of the literature,
2. should focus on needed research,
3. should focus on educational research,
4. should evolve plans for programmatic research.

The consultants commented that most research studies in learning disabilities have poorly defined the population studied. Thus, research results cannot be compared with any degree of confidence. This has hampered the building of a body of knowledge in the field of learning disabilities.

RECOMMENDATIONS CONCERNING THE STUDY OF TRAINING

The consultants recommended that the LTI's study of training:

1. should include both funded and non-funded university training programs plus in-service training programs,
2. should attempt to generate new models of training,
3. should specify personnel needs at all levels,
4. should consider the need to coordinate training, research, and service practices.

APPENDIX C

REPORT ON THE CONFERENCE OF STATE CHILD SERVICE DEMONSTRATION PROGRAMS

November 14 - 16, 1971

J. Lee Wiederholt

with

Rena Lewis

August 1972

INTRODUCTION

On November 14, 15, and 16, 1971, the Leadership Training Institute in Learning Disabilities (LTI) held a conference for the leadership personnel from the State Child Service Demonstration Programs (CSDP). This conference was sponsored by the LTI in accordance with its goal of providing technical assistance to the State Child Service Demonstration Programs funded by the Bureau of Education for the Handicapped.

Child Service Demonstration Programs are located in eight states: California, Colorado, Mississippi, New Jersey, Ohio, Utah, Washington, and Wisconsin. Representatives from these programs met with the LTI staff and consultants at this conference. Also attending were representatives from BEH. Below is a list of conference participants:

Child Service Demonstration Program Personnel

California: Dr. Margaret Scheffelin, Project Director
Ms. Joyce Kohfeldt, Project Head
Dr. Marguerite Dugger, Supervisor of Programs for Educationally Handicapped, San Francisco Unified School District

Colorado: Dr. Dale Polley, Project Coordinator
Ms. Esther Brown, Team Leader

Mississippi: Dr. Billye Bob Currie, Project Director
Mr. Herman White, State Supervisor of Special Education
Ms. Yvonne Brooks, State Consultant in Learning Disabilities

New Jersey: Dr. Daniel Ringelheim, Project Director
Mr. Paul Porado, Project Monitor
Mr. L. Jay Lev, New Jersey ACLD
Mr. James Gifford, LD Teacher Consultant

Ohio: Mr. Joseph Fisher, Project Director
Dr. Kenneth Hunt, Consultant

Utah: Ms. Florence Magleby, Project Director
Ms. Vivian Wetzel, Diagnostic-Remedial Teacher

Washington: Mr. Harold Kunzelmann, Project Director
Dr. Lois Roth, State Superintendent of Reading

Wisconsin: Mr. Thomas Scharf, Project Director
Mr. Gordon Jensen, Coordinator of Behavior and Learning Disabilities Programs, Milwaukee Public Schools

Consultants to the LTI

Dr. Eugene Ensminger, Georgia State University

Mr. Frank King, Consultant, Iowa State Department of Public Instruction

Representatives from BEH

Mr. Laurence Lieberman

Ms. Sherry Wright

The specific objectives of this conference were the following:

1. The establishment of an atmosphere of communication and coordination among the Child Service Demonstration Programs and between the LTI and the CSDP's.
2. The delineation of the LTI's relationship to the Child Service Demonstration Programs.
3. Reports on the progress and the problems in the development of the individual CSDP's.
4. The specification of the needs of each CSDP for technical assistance from the LTI.

This paper presents: (1) an explanation of the tasks of the LTI as presented at this conference, (2) a brief progress report from each CSDP, and (3) a listing of the CSDP needs for technical assistance as delineated by the personnel from the programs and by the LTI consultants.

TASKS OF THE LEADERSHIP TRAINING INSTITUTE

At this conference, the tasks of the LTI for the current year were explained to the State leadership personnel. One of these, that of providing technical assistance to the CSDP's, was explained in detail. This task includes: (1) an analysis of the proposals of the eight CSDP's, (2) communication with the programs regarding needs for technical assistance, (3) the provision of technical assistance and professional consultation to the CSDP's, (4) hosting of a conference of leadership personnel from the programs, and (5) the development of other coordinating services upon mutual agreement between the programs and the LTI.

CONFERENCE PROGRESS REPORTS OF THE CHILD SERVICE DEMONSTRATION PROGRAMS

California

This project is a three-fold Educationally Handicapped renewal program. Educational services are provided to parents and to special and regular teachers in order to increase their competencies in dealing with learning-disability pupils. The goal is to decrease the time between referral and the provision of services to children. The staff of the California program stated that a major problem involved explaining to parents and teachers that in many cases the CSDP would not work directly with children but with the parents and teachers themselves. In addition, they stressed the need for evaluation procedures other than pretest, post-test designs using standardized tests.

Colorado

The Colorado program is based on the resource center model where children are screened on the WISC, PPVT, and ITPA. An analysis is made of the assets and deficits of each child, and a program based upon a game is prescribed for use by the regular classroom teacher with the entire class. The initial team in the resource center will in turn train other teams throughout the state. The staff reported that they needed to become familiar with other ways to do what they are doing and to evaluate the practices.

Mississippi

This program is really in the fourth year and was previously funded under Title III. The duties of the teachers in this project include meeting with teaching teams to discuss materials and techniques, to make organizational plans, and to orient the teachers to individual instruction. The problems encountered by the program were in matching appropriate instructional programs to specific children and in finding qualified staff. They also expressed the need for additional skill in analyzing instructional materials and for in-service training and evaluation. The staff reported that much time was spent educating other personnel such as school superintendents, administrators, and regular classroom teachers.

New Jersey

This program is a delivery system of instructional materials based upon a computer resource unit. The goal is to help teachers plan for whole classes of children and individual students who need specific instruction. The problems encountered were teacher fear of "computer replacement" and the lack of adequate instructional programs in the computer. There are three teletype terminals in the state with direct hookups to the computer at University State College in Buffalo, where the instructional models are stored. The staff hopes for 500 requests for service per month at a cost of $2 per child.

Ohio

The staff in this project works closely with the regular classroom teacher. Three models are employed: (1) special class placement, full time, (2) tutorial program in the school, and (3) teacher consulting help. The staff reported problems in the identification of students with learning problems and in delineating the skills necessary to be a successful teacher and/or teacher consultant.

Utah

This program is based on the resource room model with three teachers and back-up personnel serving 10 to 24 children for fifteen minutes to 1/2 hour per day. This model was selected since it conforms to state laws and can be implemented throughout the state. Some of the problems were in the areas of in-service training, lack of parental involvement, and a lack of communication between the teachers in this program and the regular classroom teachers.

Washington

This program trains teachers to use precision teaching. Data is being gathered to establish basic norms or cycles of proficiency rate. One hundred teachers have been contacted to work with this technique. The program is concerned with providing teachers with an organized procedure for dealing with instructional content. The content itself is not a concern because the technique can be used with whatever is being taught.

Wisconsin

A diagnostic team comprised of a physician, a psychologist, a social worker, and a speech pathologist screens referrals for learning-disability treatment. The problems encountered have been that of an abundance of diagnosis but little delivery of remedial service. The staff reported that Milwaukee is a large bureaucracy in which it is difficult to effect change.

NEEDS FOR TECHNICAL ASSISTANCE

In this section, a summary of the requests for technical assistance by the Child Service Demonstration Programs is presented. Also included are the suggestions of the LTI consultants who participated in the conference, Dr. Eugene Ensminger and Mr. Frank King.

The eight State Child Service Demonstration Programs requested that the Leadership Training Institute

1. make site visits and provide feedback to the CSDP Directors,
2. provide for specific technical assistance to the CSDP's upon request,
3. provide each CSDP with a description of each program,
4. arrange meetings between the CSDP's and the LTI at the ACLD Conference (February, 1972) and the CEC Conference (March, 1972), and
5. send representatives from each CSDP to other CSDP's for the purpose of mutual staff development.

Dr. Eugene Ensminger suggested that the LTI

1. use DCLD Day at CEC as a possible resource for input into the LTI,
2. examine Title III, EPDA, and Early Childhood Projects as a source for models to be used by the LTI,

3. provide new evaluation designs such as continuous measurement to the CSDP's,

4. develop programs for in-service training that can be used by the CSDP's,

5. act as a "sounding board" for the CSDP's and provide them with feedback,

6. clearly define the resources and parameters of the LTI relative to technical assistance,

7. make an objective evaluation of each CSDP in relation to needs and provide technical assistance to meet the needs,

8. disseminate information to the CSDP's that would increase communication and present knowledge in the field, and

9. provide evaluation designs to the CSDP's for use in validating their practices.

Mr. Frank King suggested that the LTI

1. provide assistance to the CSDP's desiring consultation on appropriate methods and systems for evaluation,

2. measure attitude changes of personnel who participate in the CSDP's,

3. encourage other funding services in each state to communicate with and commit themselves to the CSDP's,

4. develop greater concern in the CSDP's for cost accountability,

5. encourage the development of a systematic sequential plan for presenting information about the programs to administrators,

6. develop a newsletter type of communication system between the programs, and

7. facilitate better pre-planning in developing LD programs in the future.

APPENDIX D

REPORT ON THE CONFERENCE OF TEACHER TRAINERS

December 15 - 17, 1971

J. Lee Wiederholt

with

Rena Lewis

August 1972

INTRODUCTION

In December 1971, the Leadership Training Institute in Learning Disabilities (LTI) invited four teacher trainers to a conference on the status of professional preparation in the field of learning disabilities. These consultants were asked to make recommendations to the LTI concerning its study of current teacher training activities. Attending were: Drs. Howard Adelman, Virginia Brown, Doris Johnson, and Harold McGrady.

This report outlines: (1) the events of the conference, (2) the recommendations of the consultants, and (3) the action taken on these recommendations by the LTI.

EVENTS OF THE CONFERENCE

The LTI staff presented the goals of the project and asked the consultants to respond to one of these--the study of current training practices in the field of learning disabilities. The data collected thus far was presented to the consultants for their comments. These data consisted of outlines of the proposals submitted to and funded by the Training Division of the Bureau of Education for the Handicapped for the academic year 1971-72.

The consultants agreed that the training programs could not be studied until some criteria for evaluation were established. They suggested the following training program model as a basis for such criteria:

Characteristics of a Training Program:

A. Components

1. Theoretical rationale and definitions
    a. service delivery in the field
        (1) rationale
        (2) geographical
        (3) urban-rural
2. Goals and Objectives
3. Goals translated into curriculum
4. Normative curriculum translated into individualized curriculum
5. Implementation
    a. Characteristics of trainers
    b. Training activities
6. Evaluation (directed toward rationale)--quality monitoring
7. Program modification (based on evaluation)
    a. Data base
    b. Systematic planning
    c. Accountability to impact on direct services, relation to other agencies, and consistency with objectives

B. Evaluation

1. External evaluation
2. Replicability

This model was presented by Dr. Adelman in the schematic diagram which appears in Figure 1.

The consultants concluded that learning-disability training programs could not be adequately studied without more information than is provided in the proposals to BEH. Guidelines for proposal writing do not elicit data which define the character of the program. Other questions must be answered by the programs before they can be accurately described and evaluated.

RECOMMENDATIONS

On the basis of these conclusions, the consultants made the following recommendations.

More data must be collected from training programs. The training program model (presented in Figure 1) can be used to formulate pertinent areas of investigation.

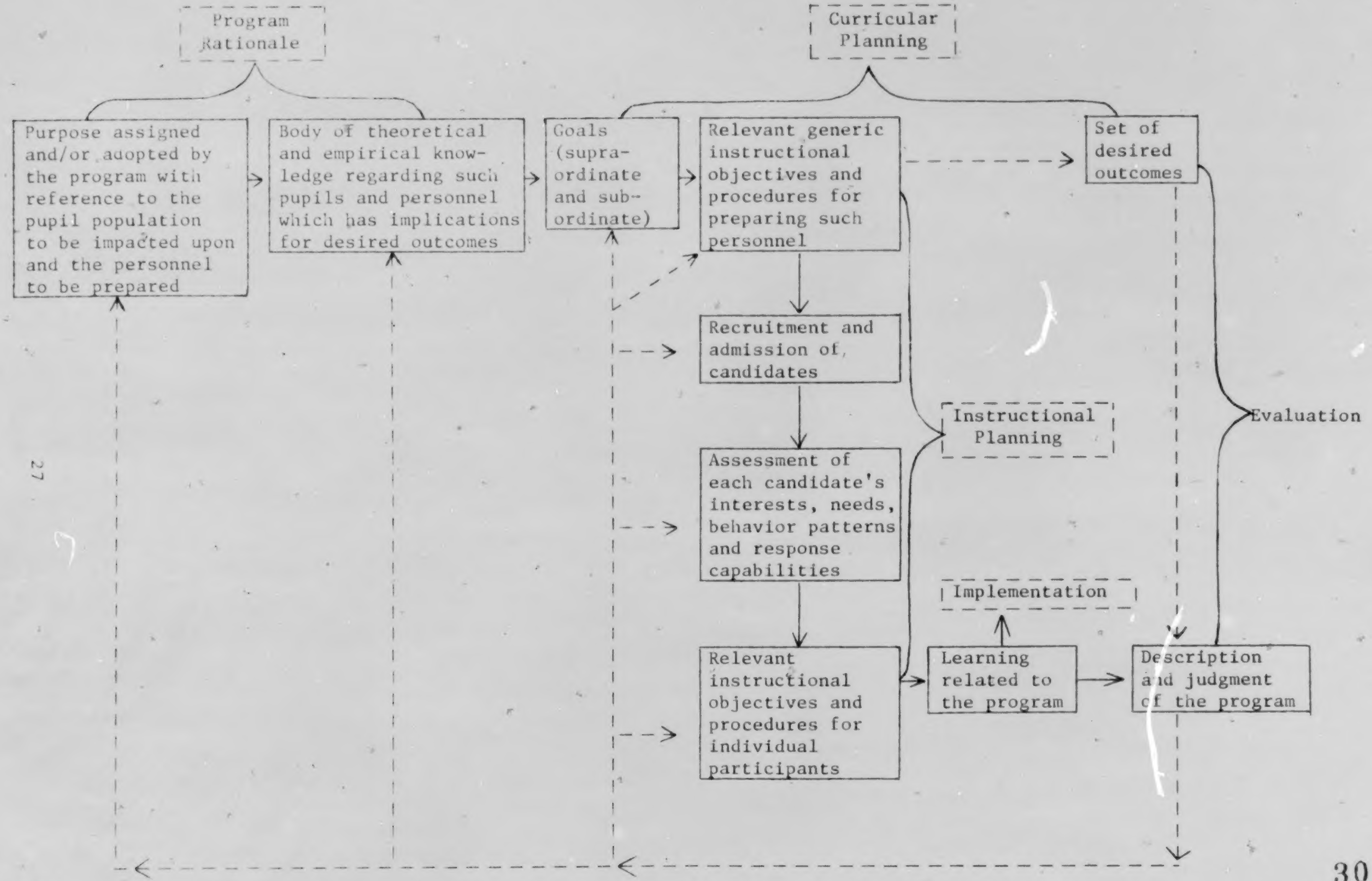
A questionnaire can be used to gather data from training programs. Such a questionnaire could be administered in phone interviews, in structured site visits, by mail, or, if possible, by all these methods.

The study of training programs should tap various types of programs. Both independent programs and those funded by BEH, undergraduate and graduate programs (including Master's, Educational Specialist, and Doctoral training), and programs with varying emphases on research, training, and service should be included. It was suggested that the questionnaire could be administered to a stratified sample representing these various types of learning-disability training programs.

The questionnaire should cover the following areas: (1) rationale and foundations, (2) curriculum, (3) instructional planning, (4) implementation, (5) formative evaluation, and (6) summative evaluation.

Examples of possible questions to be included in the questionnaire are:

1. Rationale and Foundations
    - a. Why did your program start in learning disabilities?
    - b. What is the philosophy of your program?
    - c. What is the type of person to be trained in your program?
    - d. What conditions exist on a local, state, and national level which help to maintain the existence of your program?
    - e. In planning the program, what were the major assumptions?
2. Curriculum
    - a. What course offerings are available or are needed within your program?



Program Rationale
Curricular Planning
Purpose assigned and/or adopted by the program with reference to the pupil population to be impacted upon and the personnel to be prepared
Body of theoretical and empirical knowledge regarding such pupils and personnel which has implications for desired outcomes
Goals (supra-ordinate and sub-ordinate)
Relevant generic instructional objectives and procedures for preparing such personnel
Set of desired outcomes
Recruitment and admission of candidates
Instructional Planning
Evaluation
Assessment of each candidate's interests, needs, behavior patterns and response capabilities
Implementation
Relevant instructional objectives and procedures for individual participants
Learning related to the program
Description and judgment of the program

Figure 1

b. What are the schools of thought imbedded in your curriculum?

c. What resources/climate is necessary to carry out the training?

d. How does your curriculum differ from that of other programs?

e. What competencies (knowledge and skills) do you expect your graduates to have?

3. Instructional Planning

a. What characteristics are essential in students entering your program?

b. How is your curriculum planning reflected in your instruction?

c. To what degree do students formulate their own objectives?

d. What specific modifications are made to accommodate less than "ideal" students?

e. How do you individualize instruction for your trainees?

4. Implementation

a. How and why have you modified your program over time?

b. How do you convert your objectives into practice?

c. What are the shortcomings of your implementation strategies?

d. What resources and facilities do you use to develop basic competencies?

e. How many different faculty members does the student come into contact with?

5. Formative Evaluation

a. Describe your plans for evaluating outcomes.

b. How do you maintain quality control?

c. What are the criteria you use to evaluate?

d. What are the feedback mechanisms operating in your program?

e. How do you use student output and performance to modify the program?

6. Summative Evaluation

a. Are there mechanisms to make major program changes?

b. What mechanisms do you have for insuring that results of evaluation are fed back into program modification?

c. What specific internal and external standards of evaluation do you use?

d. Do you see ways your program is likely to change and upon what basis?

ACTION TAKEN ON CONSULTANTS' RECOMMENDATIONS

In January 1972, the LTI staff enlisted the aid of Systems Technology and Services Division of Graphics, Communications Systems, Inc. (STS) of Tucson, Arizona to develop a questionnaire to be sent to learning-disability training programs. This questionnaire was written along the guidelines suggested by the consultants and is attached to this report.

The regulations on data collection for federal projects are such that this questionnaire could not be approved in time for use during this project year. Therefore, the LTI was not able to use the questionnaire to gather data on learning-disability training programs.

THE UNIVERSITY OF ARIZONA
TUCSON, ARIZONA 85721

COLLEGE OF EDUCATION
Department of Special Education

LEADERSHIP TRAINING INSTITUTE
IN LEARNING DISABILITIES
620 North Country Club Road
Tucson, Arizona 85716
January 21, 1972

Dear

The Leadership Training Institute in Learning Disabilities, a project of the Department of Special Education at the University of Arizona, has been charged by the Bureau of Education for the Handicapped, United States Office of Education, with the responsibility of summarizing the state of training in the field of learning disabilities. We are contacting you and a number of other leaders in the field to obtain your ideas and opinions about the state of learning disabilities, the way you feel it ought to develop, and to obtain information about your training program. We have prepared the attached questionnaire for this purpose.

As you know, it is not possible to get a complete picture of the philosophy, state of development, problems, and probable future development of an institution's learning-disability program from general catalogue description or a review of a funding proposal that has been submitted to the Federal government. While much data can be gleaned from an analysis of such documents, we are in need of additional detailed information about your specific program(s).

It is our desire to list you as a major contributor to the data contained in the final report of this study; however, any information you provide us will be combined with that from other institutions. Nothing you say will be identified with you or your program(s) in the report or to the government without your approval except for summary information requested on the first page. (This summary page is being sent as a separate questionnaire to all teacher training institutions in the country). As a means of indicating your desires regarding the confidentiality of your comments, all questions are prefaced with a small circle. A check placed in that circle will indicate to us your desire for confidentiality over the content of the response you provide.

We believe that this study provides those of us working directly in the field with an opportunity to inject your ideas into an analysis that could very well have a major influence on the immediate and long-range future of learning disabilities. We hope you will fully express your recommendations and comments about the field as well as giving data on your training program.

We ask that you return the completed questionnaire to us within a week or two so that a coordinated analysis can be made of all the data. A stamped envelope is included for your convenience. Should you have any questions about the study or the questionnaire, please do not hesitate to contact Dr. Dale Bryant, Project Director, at telephone number (602) 884-3116. Your responses to the questionnaire will be analyzed in detail and will be used as the basis of a follow-up telephone conference with you should it be necessary to obtain clarifying comments on your ideas, suggestions, or the specific information you provide.

Upon completion of the final report, we will forward a personal copy of that document to your office. Thank you for your assistance in this study.

Sincerely,

N. Dale Bryant, Ph.D.
Project Director

NDB/cw
Enc.

PLEASE FILL OUT AND RETURN AS SOON AS POSSIBLE
Enclosed find stamped envelope addressed to:

Leadership Training Institute
in Learning Disabilities
620 North Country Club Road
Tucson, Arizona 85716

____
Institution

______________________________ ______________________________
Person completing questionnaire Position

1. Do you have a program for training learning disability teachers, specialists, consultants or other personnel to work specifically to aid learning disability children? (Please include programs that are essentially the same as learning disability programs even if a different term is used.) ( ) Yes ( ) No

2. What is your program(s) called? ( ) Learning Disabilities
( ) Neurologically Impaired ( ) Resource Room Teacher
( ) Educationally Handicapped ( ) Other (Please specify) ____________

3. Please enter where appropriate the approximate current enrollment for full-time (FT) and part-time (PT) students in L.D. program(s).

Undergraduate	Masters	Post Masters (Non-Doctoral)	Doctoral
FT____PT____	FT____PT____	FT____PT____	FT____PT____

4. Please enter the number of full-time and part-time personnel in each of the following categories for your L.D. program(s).

Instructors, Professors	Supervisors	Others (Please Specify)________
FT____PT____	FT____PT____	FT____PT____

5. What department offers the L.D. program(s)?

( ) Special Education ( ) Other (Please specify) ____________________

6. How many courses do you have that predominately deal with learning disabilities? ____________

7. Do you offer other work in learning disabilities?

( ) No ( ) In-service Training
( ) Summer Workshops ( ) Other (Please specify) ____________________

8. If a new program in learning disabilities is planned, please give level and year you expect to initiate it: ______________________________

9. If you have a program or work in learning disabilities, please give the following information about the person most directly responsible for the area.

Name ______ Degree ______ Telephone number ______

Title ______

Address ______

I. BACKGROUND DATA

A. DEFINITION OF "LEARNING DISABILITIES".

The First Annual Report of the National Advisory Committee on Handicapped Children, dated January 31, 1968, provides the following definition of "learning disabilities":

"Children with special learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written languages. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling, or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc. They do not include learning problems which are due primarily to visual, hearing or motor handicaps, to mental retardation, emotional disturbance or to environmental disadvantage."

○ 1. Do you agree with this definition?

Yes, I am in complete agreement - - - - - - - - - - - - - - - - - - ( )
I agree with most of it but would make some changes - - - - - - ( )
No, I don't agree with most of it - - - - - - - - - - - - - - - - - ( )

○ 2. If you do not completely agree with this definition, please indicate your reason(s) for disagreement.

a. The definition should not be limited to disorders in basic psychological processes - - - - - - - - - - - - - - - - - ( )

b. The definition is too broad; it should not include conditions which have been referred to as:

Perceptual Handicaps- ( )
Brain Injury- ( )
Minimal Brain Dysfunction - - - - - - - - - - - - - - - - - - - ( )
Dyslexia- ( )
Developmental Aphasia - ( )

c. The definition is too broad; it should not include disorders in:

Listening - - - - - ( )
Thinking- - - - - - ( )
Talking - - - - - - ( )
Reading - - - - - - ( )
Writing - - - - - - ( )
Spelling- - - - - - ( )
Arithmetic- - - - - ( )

d. The definition should have specifically excluded the following: (Please specify)

____

____

e. The definition is too narrow; it should also include learning problems that are due primarily to the following:

Visual Handicaps -( )
Hearing Handicaps- -( )
Motor Handicaps- -( )
Mental Retardation -( )
Emotional Disturbance- -( )
Environmental Disadvantage - - - - - - - - - - - - - - - - - - -( )

f. The definition should specifically include the following: (Please specify)

____

____

g. If the information you have given above doesn't completely clarify your own definition, or if you prefer different wording, please give your own definition below:

____

____

____

____

____

h. Is your program(s) based upon your definition:

Yes- -( )
No (Please specify differences)- - - - - - - - - - - - - - - - -( )

____

○ B. PREVALENCE OF LEARNING DISABILITIES

According to the definitions of learning disabilities, what is your estimate of the prevalence of L.D. in the national school population:

Your definition - ________%
Definition upon which your program is based - - - - - ________%
National Advisory Committee definition- - - - - - - - ________%

II. TRAINING PROGRAMS

A. RATIONALE

○ 1. What is the theoretical rationale (school of thought) underlying your program?

○ 2. Into what jobs do most of your graduates of L.D. program(s) go?

Undergraduate:

Masters:

Post-Masters (Non-Doctoral):

Doctoral:

B. INITIATION OF PROGRAM(S)

○ 1. Please enter the academic year of initiation of each of your training programs (include the developmental grant year, if applicable).

Undergraduate	Masters	Post-Masters	Doctoral

○ 2. What factors had a major influence on the initiation of your program(s)? Please specify where possible.

Federal Funding - ( )
Available Personnel - ( )
State Legislation in L.D. - - - - - - - - - - - - - - - - - - - ( )
Pressure Groups - ( )
Efforts of a Specific Individual- - - - - - - - - - - - - - - - ( )

Please enter name ______________________________

Other Factors (Please Specify) ______________________________

____

____

○ 3. Approximately how many years of full-time graduate study are required to complete your program(s)?

Masters ( )   Post-Masters (Non-Doctoral) ( )   Doctoral ( )

C. GROWTH

This section pertains to the status of your program(s) at year of initiation, currently, and estimates for the 1972-1973 academic year.

○ 1. For each program, please enter full-time (FT) and part-time (PT) enrollment.

	Initial		Current		1972-73	
	FT	PT	FT	PT	FT	PT
Undergraduate						
Masters						
Post-Masters						
Doctoral						

○ 2. Please enter the number of full-time (FT) and part-time (PT) personnel in each category.

	Initial		Current		1972-73	
	FT	PT	FT	PT	FT	PT
Instructors, Professors						
Supervisors						
Others						

○ 3. Of the instructors and professors in your L.D. program(s), what was the one major area of specialization in their own graduate training? (Enter the number of individuals in each category.)

Learning Disabilities (or equivalent term) - - - - - - - ________
Other Sp. Ed. (Please specify) - - - - - - - - - - - - - ________
Remedial Reading - ________
Speech - ________
Educational Psychology - - - - - - - - - - - - - - - - - - ________
Other Psychology - ________
General Education- ________
Other (Please specify) - - - - - - - - - - - - - - - - - - ________

○ 4. Please enter the number of courses that predominately deal with L.D.

Initial	Current	1972-73

○ 5. Please enter the number of practicum facilities of each category.

	Initial	Current	1972-73
Educational Clinics			
Schools			
Other Facilities (Please specify)			

○ 6. We would welcome additional comments about the future development of your program(s) and/or the needs of the field.

7. How much importance and emphasis did your program give initially and does it give now to the following approaches? Please use the rating scale and add other approaches where needed to characterize your program.

1 = Extremely important, no approach is more basic or more emphasized

2 = Important, emphasized in the program

3 = Used, but not emphasized

4 = Not used, even though it may be discussed

	Initial	Current
a. Training motor and/or perceptual-motor deficits.		
b. Training deficits in underlying psychological or psycholinguistic processes (other than perceptual-motor).		
c. Overcoming emotional blocks to learning.		
d. Reducing distractibility by environmental control and structured tasks.		
e. Modifying behavior by reinforcement to intensify involvement in learning.		
f. Corrective work by repeating regular classroom program by individualized.		
g. Remedial instruction of specific deficiencies of educational subskills.		
h. Programming instruction in exceptionally small, sequential steps.		
i. Identifying and using learning strengths whenever possible.		
j. Other (please specify)		
k. Other (please specify)		
l. Other (please specify)		

D. PROGRAM CONTENT

○ 1. This question deals with three specific aspects of L.D. programs:

a. Those areas usually required for admission into your present program(s) (ADMIS). If a particular knowledge, skill or experience is required for admission into a program, please place a check in the column entitled ADMIS.

b. Using the scale below, rate the degree of emphasis a particular area plays in your present program(s) (EMPHAS).

c. Using the scale below, rate the degree of emphasis a particular area should play in an ideal program (IDEAL). Assume that you could develop your program in any way that you desire as long as the program itself is practical. You should also assume the availability of adequate support, resources, and faculty for the L.D. program and both adequate numbers and quality of faculty and offerings in the related areas.

Rating Scale for PRESENT EMPHASIS and IDEAL

0 = No part in the program
1 = A very minor part in the program, covered but not emphasized
2 = Given slight emphasis
3 = Given moderate emphasis
4 = Given extreme emphasis, a major aspect of the program

Area of Knowledge, Skill or Experience	Undergraduate			Masters			Post-Masters			Doctoral		
	ADMIS (✓)	EMPHAS rate	IDEAL rate	ADMIS (✓)	EMPHAS rate	IDEAL rate	ADMIS (✓)	EMPHAS rate	IDEAL rate	ADMIS (✓)	EMPHAS rate	IDEAL rate
Course work in general education	( )			( )			( )			( )		
Experience in regular classroom teaching.	( )			( )			( )			( )		
Skill in teaching of L.D. self-contained classrooms.	( )			( )			( )			( )		
Learning theory and principles.	( )			( )			( )			( )		

Area of Knowledge, Skill or Experience	Undergraduate			Masters			Post-Masters			Doctoral		
	ADMIS (✓)	EMPHAS rate	IDEAL rate	ADMIS (✓)	EMPHAS rate	IDEAL rate	ADMIS (✓)	EMPHAS rate	IDEAL rate	ADMIS (✓)	EMPHAS rate	IDEAL rate
Emotional disorders and adjustment.	( )			( )			( )			( )		
Knowledge of social and cultural factors.	( )			( )			( )			( )		
Behavior modification skill.	( )			( )			( )			( )		
Neuropsychological functions and dysfunctions.	( )			( )			( )			( )		
Skill in diagnostic procedures.	( )			( )			( )			( )		
Knowledge of tests used in L.D. diagnosis and remedial planning.	( )			( )			( )			( )		
Skill in remedial teaching of groups.	( )			( )			( )			( )		
Skill in remedial teaching of individuals.	( )			( )			( )			( )		
Consulting with classroom and Special Education teachers.	( )			( )			( )			( )		
Consumer of research. Use of research in planning work.	( )			( )			( )			( )		
Skill in performing research.	( )			( )			( )			( )		
Curriculum Modification.	( )			( )			( )			( )		
Construction of new teaching materials and procedures.	( )			( )			( )			( )		
Knowledge of standard remedial materials and programs.	( )			( )			( )			( )		
Knowledge of the other areas of Special Education	( )			( )			( )			( )		
Skills in Teacher Training	( )			( )			( )			( )		

Area of Knowledge, Skill or Experience	Undergraduate			Masters			Post-Masters			Doctoral		
	ADMIS (✓)	EMPHAS rate	IDEAL rate	ADMIS (✓)	EMPHAS rate	IDEAL rate	ADMIS (✓)	EMPHAS rate	IDEAL rate	ADMIS (✓)	EMPHAS rate	IDEAL rate
Skills in administration.	( )			( )			( )			( )		
Skill in counseling parents.	( )			( )			( )			( )		
Skills in psychotherapeutic interaction with children.	( )			( )			( )			( )		
Satisfactory performance on standardized test such as GRE, Miller Analogies, or	( )			( )			( )			( )		
Other (please specify)	( )			( )			( )			( )		
Please add other areas of knowledge, skills, experiences or attitudes, that are required for admission or that are given considerable emphasis or a major focus in your program(s).												

○ 2. What percent of L.D. Student's time is given to each of the following?

	Undergrad	Masters	Post-Masters	Doctoral
Core Work in L.D.	%	%	%	%
Other areas of Spec. Ed.	%	%	%	%
Work in related fields.	%	%	%	%
Other (Please specify)	%	%	%	%

○ 3. Of the work in L.D., what is the relative percentage of student time spent on practicum and non-practicum work?

	Undergrad	Masters	Post-Masters	Doctoral
Practicum	%	%	%	%
Non-Practicum	%	%	%	%

○ 4. Of the work in L.D., what is the relative percentage of student time given to the following areas?

	Undergrad	Masters	Post-Masters	Doctoral
Theory and General Information about L.D.	%	%	%	%
Diagnosis	%	%	%	%
Remediation and Treatment	%	%	%	%
Other (Please specify)	%	%	%	%

E. EVALUATIONS

○ 1. What methods of evaluation do you use to determine acceptable completion of the L.D. program? (Please check all that are used.)

	Undergrad	Masters	Post-Masters	Doctoral
Evaluation in courses				
Evaluation by faculty other than in courses				
Comprehensive Examination				
Performance in Practicum				
Self Evaluation				
Other (Please specify)				

○ 2. Do you use any non-traditional or innovative evaluation techniques for evaluating student competencies?

No- -( )

Yes (Please specify)____( )

____

○ 3. Do you evaluate "on-the-job" competencies after the student graduates?

No- -( )

Yes (Please specify how)____________________________________( )

____

○ 4. Do you have specific, systematic procedures for evaluating the success of your program(s) and revising it?

No specific procedures, just informal professional judgment - - - -( )

Yes (Please specify)____( )

____

III. RECOMMENDATIONS

○ A. In the next five years in this country, how many L.D. personnel do you think should be trained each year in comparison with the number trained this year?

	Less than now	Same as now	More than now
Self-contained classroom teacher			
Itinerant teacher			
Resource Room teacher			
Teacher Consultant			
Educators of L.D. Teachers			
Researcher			
Clinic L.D. Team Member			
Other (Please specify)			

○ B. What recommendations, if any, do you have to increase the quality and quantity of service to L.D. children or in other ways advance the field of Learning Disabilities?

1. Recommendations to the Federal Government:
2. Recommendations to the State Government:
3. Recommendations to Local Government and/or schools:
4. Recommendations to Professional Organizations or Field as a whole:
5. Recommendations to Training Programs:
6. Recommendations for research:
7. Other:

IV. ADDITIONAL COMMENTS

We would appreciate any additional comments that will provide insight into your L.D. program(s) or that give your views on L.D. training in general. In addition, we would appreciate your sending any pre-printed information regarding your program(s).

APPENDIX E

SCRIPT OF THE LTI'S SLIDE PRESENTATION TO DCLD AT THE MARCH 1972 COUNCIL FOR EXCEPTIONAL CHILDREN CONFERENCE

March 21, 1972

Corrine E. Kass
with
Rena Lewis
Marilyn Johnson

August 1972

Good morning. We at the LTI would like to introduce ourselves and tell you something about our purpose. Here is the Leadership Training Institute in Learning Disabilities. We are located in Tucson, Arizona at the University of Arizona and we are a project of the Bureau of Education for the Handicapped.

Here is our staff: Dr. Dale Bryant, Project Director; Dr. Corrine Kass, Associate Project Director; Dr. Samuel Kirk, Consultant in Residence; Dr. Lee Wiederholt, Research Associate; and Mrs. Rena Lewis, Administrative Assistant. Also, our secretary, Miss Johnine Taylor. And, our part-time student staff: Don Deshler, Nancy Stiefel, Diana Ross, Marilyn Johnson, and Laura Fliegner--and John Wissink, Jay McLoughlin, Chuck Kaiser, and Jim DeRuiter.

We have told you who we are. Now, you are probably wondering what we do. Our purpose is to study the field of learning disabilities--what it is, how it has developed, and the direction of its development. To explain this, we're going to use the analogy of a case study.

First of all in a case study in the Case Information. In this case, the field of learning disabilities has been referred by the Bureau of Education for the Handicapped. The legislative age of the term "learning disabilities" is three years--starting with the LD Act of 1969. The fiscal age is nine months--from July first, 1971, the beginning of the current fiscal year. The field's school is special education. The year 1971-72 is the date of referral and the LTI is the examiner.

Next in a case study is the Referral Information. In spring 1971, the the Division of Services of the Bureau solicited competitive proposals from universities across the country for one LTI in learning disabilities. This was awarded to the University of Arizona. The guidelines for these proposals indicated that the Bureau's reason for referral was to obtain a "state of the art" of learning disabilities. To use more professional language, this involves a study of current available resources in learning disabilities, with major focus on three areas: model services, research, and training.

It should be noted that learning disabilities was initially referred to BEH by parent groups such as the Association for Children with Learning Disabilities (ACLD). These parent groups made their referral via Congress.

Now let's look at the Background Information. First, we have the field's Family Background. In its early years, the field was a legislative orphan. No laws mentioned learning disabilities. But LD was taken in and cared for by foster parents--the category "Crippled and Other Health Impaired" (or COHI). In 1969, learning disabilities found its legitimate parents with the LD Act--and thus it became a legislative category all unto itself.

Next is Developmental History. Developmentally, the field has suffered from nutritional deprivation, i.e., too little money. However, since 1964 there have been funds available for fellowships to teacher training programs. This aspect of the field has developed fairly normally. Research has also been funded over the years but its growth has been sporadic and it still lags behind teacher training. Services were greatly enhanced in 1967 when an amendment of the Elementary and Secondary Education Act, Title III, made service funds available for handicapped children. Many Title III projects provide supplementary services to children with learning disabilities.

Last under Background Information is the field's School History. Learning Disabilities in the early years was housed almost exclusively in private schools and other private facilities such as speech and remedial reading clinics, doctors' offices, and parent-sponsored services. Gradually, with increases in state legislation, it has moved into the public schools.

Let us now talk about the job of the LTI this year--that is, how the LTI is dealing with the referral request for a "state of the art" of learning disabilities. In our case study analogy, this is the section called Diagnostic Strategies. All the referral and background information that we've looked at gives the direction in which to procede in our diagnosis. The LD legislation refocuses on three areas of importance and these are: 1) model services, 2) research, and 3) training. Therefore, the LTI is looking at these three aspects of the field in order to arrive at a picture of the total field.

Let's look more carefully at these three aspects. The model services we're focusing on are the eight model centers funded in 1971. These new centers, called Child Service Demonstration Programs, are in eight states--Washington, California, Utah, Colorado, Mississippi, Wisconsin, Ohio, and New Jersey.

Research is defined as current knowledge. In other words, the LTI is concerned with the field's present body of research results and implications and service strategies.

The study of teacher training concentrates on colleges and universities with federally-funded learning disabilities programs. There are 37 such programs spread across the country.

Now that you have an idea of the scope of our work, let us tell you how we're attacking this work. Basically, we have two methods--the first being Test Results and Interpretation, the second Clinical Observations. Test Results are analogous to hard data--and, for the LTI, encompass three provinces: people, paper, and programs.

Paper is plentiful. For all of the federally-funded state and training programs, there are proposals which we have outlined and abstracted. Also, we have written letters, sent out questionnaires, and perused books and journals, and microfilms of dissertations and microfiche.

We also obtain data from programs--generally from site visits.

And our most important source is people. We talk--and listen--by phone, at conferences, at meetings. We have held several conferences in Tucson this year where we have talked with consultants, people from the state programs, teacher trainers, and others. We have attended conferences in order to get information from people--and later this morning, we hope to get information from you also.

We are interpreting these data in many ways--by using systems analysts, charts, summaries, computer analysis, etc.

But we see the most important and meaningful interpretation as being clinical or impressionistic--the Clinical Observation part of the case study. In other words, data plus people's impressions must be sifted, analyzed, synthesized, and evaluated so that they may be translated into a thoughtful overview of the field of learning disabilities. To be a Gestaltist for a moment, we are looking at not only the bits and pieces, the individual datum, but also and more importantly the whole. There are two factors in consideration here--accuracy and artistry. Clarity and accuracy do not necessarily product art. And in achieving art, some clarity is lost. What we are trying to do is paint a picture of the field, not snap a photograph. And in painting this picture, we will add light and shadows, perspective, and blend colors together--but the final portrait should give more information about the essence, the mood, the character of the field than would a mere photograph. Thus, the LTI wishes to preserve accuracy but augment it with artistry in the hope of attaining first quality, and then quantity.

Now we come to the last and most crucial part of the case study--Recommendations. Once the picture of the field, our analysis of its present level of functioning, is complete, the LTI and selected consultants will make recommendations to the Bureau. These recommendations will include suggestions for future funding in the three Divisions--service, research, and training.

Our three Final Reports on model services, training, and research will thus each include two aspects--a picture of the present and recommendations for the future. These reports will become available sometime after the close of the project year.

As mentioned before, we'd like for you to give us some information today since you represent the professional organization in learning disabilities. Dr. Kass will explain the procedure for small group discussions after we answer any questions you may have.

APPENDIX F

REPORT ON THE MEETING OF DCLD
AT THE MARCH 1972 COUNCIL FOR EXCEPTIONAL CHILDREN CONFERENCE

March 21, 1972

Rena Lewis

August 1972

INTRODUCTION

On Division Day of the 1972 CEC Conference, the Leadership Training Institute in Learning Disabilities (LTI) presented the morning program of the Division for Children with Learning Disabilities (DCLD) meeting. First, the LTI staff presented a short lecture (which appears in Appendix E) with slides in order to acquaint the DCLD membership with the work of the LTI. Then, the audience was divided into small discussion groups. Each group was led by an LTI consultant, DCLD officer, representative from the Bureau of Education for the Handicapped, or LTI staff member. Topics for discussion were chosen by the group chairman.

The purpose of these discussions was to sample the views of DCLD members on various issues in the field of learning disabilities. This report will present: (1) a list of discussion topics and chairmen, (2) general comments concerning the discussions, and (3) a summary of trends and issues emerging from the discussions.

LIST OF DISCUSSION TOPICS AND CHAIRMEN

Certification and Competencies--Dr. Paul Ackerman

Competency-Based Training--James McLoughlin

Ethics in Publication of Materials--Nancy Stiefel and Diana Ross

Identification and Screening of Relevant LD Teacher Preparation Programs--Dr. James Cleveland

In-Service Training--Dr. Vilma Falck

Job Market--Dr. Mario Pascale

LD Specialist in a Non-categorical Set-up--Laura Ganoung

Learning Disabilities in the Face of Changing Universities--Dr. Lee Wiederholt

Major Competencies Needed by Master's Level Teachers in LD--Laurence Lieberman

Methods and Materials--Dr. Floyd Hudson

Professional Ethics--Dr. Alice Thompson

Remedial Reading versus Learning Disabilities--Charles Kaiser

State Program Development Concerns--Frank King and Carolyn Elliot

GENERAL COMMENTS CONCERNING THE DISCUSSIONS

All the topic discussions were spirited and lively. Minutes were taken by a recorder in each group. These minutes reveal that the areas of discussion were not always the same as the group topic. Also, few conclusions can be drawn about the general feelings of the participants on any one topic. Therefore, the next section will simply enumerate some of the issues and trends most frequently mentioned in the topic discussion minutes.

SUMMARY OF ISSUES AND TRENDS EMERGING FROM THE DISCUSSIONS

The DCLD members participating in these discussions stated repeatedly that labeling of children was bad. Many discussed the disadvantages of segregation and the need for integrating learning-disability children into the regular classroom.

Another major issue was that of the trend toward decategorization and its influence upon competencies needed by the LD teacher. Many participants noted the incongruence between the push for decategorization and the categorical funding and teacher certification requirements. There was much debate concerning the competencies needed by different types of LD personnel (itinerant, consultants, etc.) and by non-categorical "generalist" personnel.

A third major issue was training of personnel. Some felt the teacher renewal strategy was the best way to meet personnel needs. Others advocated paraprofessionals (including parents) or undergraduate training programs. Most agreed that in-service training was much needed.

There was little discussion on theoretical issues or methods of teaching children. A few DCLD members commented on the medical influence in the field, some for and some against. There was little debate on how or what to teach children. However, many participants expressed the need for the evaluation of the great supply of published materials.

In summary, although the DCLD members did not concur on all topics of discussion, they did evidence much agreement in their isolation of the current issues and trends in the field of learning disabilities.

APPENDIX G

REPORT ON THE SEMINAR OF SCHOLARS

May 24 - 27, 1972

Rena Lewis

August 1972

INTRODUCTION

Several leaders in the field of learning disabilities were invited to participate in a Seminar of Scholars, sponsored by the Leadership Training Institute in Learning Disabilities (LTI). The purpose of this meeting was to sample expert opinion concerning both the current direction in which the field is moving and the ideal direction.

Excerpts from the invitation letter follow:

> This year, the Leadership Training Institute in Learning Disabilities has been making a survey and analysis of the "state of the art" in the field of learning disabilities. We are collecting current knowledge in research, training, and services. Basically, we are employing two methods: (1) data are being collected from federally-funded projects, from the literature, and from direct communication with consultants and other personnel in the field; (2) impressions of the "state of the art" are being solicited from a selected list of consultants to the Leadership Training Institute.
>
> This latter method is the one that we are writing you about. Until now, we have spent most of our time collecting data under the first method. Now we must get input about the essence and character of the field. We are therefore inviting you to join us in a special seminar of scholars at which you will be asked to give your organized view of the field. What our experience has shown is that the hard data we have collected do not translate easily into a "state of the art." We feel that presentations from our consultants will provide us with a more synthesized and thoughtful overview of the field.
>
> The format for this meeting will include the following: (1) A half-hour input lecture by each participant. This need not be in written form; (2) Reaction and questions by other participants. This seminar will then be written up in a proceedings which will be part of our final report to the Bureau of Education for the Handicapped, Office of Education.

Participants in the Seminar of Scholars included LTI staff members and the following consultants:

Dr. James Chalfant
Dr. Norris Haring
Dr. Doris Johnson
Dr. Barbara Keogh
Dr. Jeanne McCarthy
Dr. Gerald Senf
Dr. Charles Strother

This report is divided into two main sections: (1) a summary of recommendations made by the Seminar of Scholars, and (2) a transcript of the seminar proceedings.

SUMMARY OF RECOMMENDATIONS OF THE SEMINAR OF SCHOLARS

Proposed Research Strategy and Criteria

The Seminar of Scholars concurred that the most urgent need of the field of learning disabilities at the present time is the need for accumulation of knowledge. The Seminar then isolated three major research questions which were felt to be the most fruitful areas of investigation. These questions are:

1. How can an explicit operational definition of the population of children with which we are concerned be developed?
2. How can a remedial technology that will effectively modify the behavior of these children be developed?
3. How can this technology be translated into an efficient service delivery system?

Alternative strategies for attaching each question were then formulated.

Question 1: How can an explicit operational definition of the population with which we are concerned be developed? It was agreed that there is urgent need for an operational definition in order to allow comparison of research results. The following strategy for evolving an operational definition and a description of the characteristics of the population was devised.

Step 1: Selection of initial population. The initial population shall include all children referred by teachers, parents, etc. as having learning problems or difficulties.

Step 2: Selection of subpopulation. If, for any reason, it is decided to exclude any children from the initial population gathered in Step 1, the criteria for exclusion should be stated explicitly so that the procedure can be replicated. If it is decided to include only a part of the initial population, the criteria for inclusion should be stated explicitly so that the procedure can be replicated. (NOTE: The field of learning disabilities acknowledges its responsibility to provide services for children with severe learning problems whether they be learning-disability children or others. However, the purpose of this strategy is to formulate a definition for research purposes.)

Alternative A. Children shall be excluded from the initial population if their learning problems are due to causes other than learning disability, e.g., mental retardation, visual impairment, etc.

Alternative B. Children shall be selected from the initial population by a test procedure which assesses ability to learn.

If the child's performance does not improve within a standard period of time with standard presentations of either academic tasks or other developmentally appropriate tasks, he will be included in the subpopulation.

Alternative C. A combination of alternatives A and B.

Step 3: Determination of characteristics of the subpopulation.

Alternative A. The subpopulation shall be described in terms of the precise academic responses they are making in the regular classroom situation.

Alternative B. The subpopulation shall be described in terms of a profile of their cognitive abilities and disabilities.

Alternative C. The subpopulation shall be described both in terms of a profile of cognitive abilities and disabilities and also in terms of affective, motivational, situational, environmental, demographic, and other non-academic characteristics.

Step 4: Identification of homogeneous subgroups within the heterogeneous subpopulation. There are two empirical questions which must be answered once homogeneous subgroups are found: (1) To what extent do the different approaches in Step 3 lead to different groupings, or do all approaches arrive at essentially the same groupings? (2) Which system of classification is most relevant to efficient remediation?

Question 2: How can a remedial technology which will effectively and efficiently modify the behavior of learning-disability children be developed? It was agreed there is urgent need to validate new and existing remedial methods and materials, which are collectively termed "remedial technologies."

Step 1: Statement of rationale. The rationale on which the proposed technology is based must be described. The rationale should include a statement of the frame of reference or model, and a specification of goals.

Step 2: Description of technology. The intervention must be described explicitly in terms of curriculum, method, materials, setting, community, etc.

Step 3: Measurement of changes in child's behavior. In order to determine if changes have been effected in the child's behavior, performance should be measured if possible on (a) specific tasks in various contexts, (b) similar tasks in various contexts and, (c) dissimilar tasks in various contexts. Measurement should be done both directly after treatment and after a reasonably long period of time. It is the responsibility of the investigator to state explicitly the tasks on which performance is measured.

Step 4: Demonstration of the relative efficiency of this technology. The relative efficiency of this technology should be tested by comparing it with other technologies on similar populations.

Question 3: How do we translate this technology into an efficient service delivery system? It was agreed this would be the next logical question.

Specific Recommendations

1. The Bureau of the Education for the Handicapped should:

   a. Make research the number one funding priority.

   b. Utilize the research strategy outlined above both for proposal guidelines and for evaluation of proposals.

   c. Promote programmatic research in learning disabilities.

The seminar outlined the following procedures for persuading BEH to follow the above suggestions:

   a. Dr. Norris Haring was charged with the responsibility of presenting the Seminar's conclusions about the need for research and the proposed research strategy to the National Advisory Committee.

   b. The LTI was charged with the task of formulating guidelines on the basis of the research strategy for both writing and evaluation of proposals.

2. Professional journals should include the research criteria proposed by the Seminar as part of their selection procedure. For example, no research article should be considered for journal publication unless it explicitly specifies the methodology by which the population was selected. The Seminar drew up the following procedures to persuade journals to use the prepared research criteria:

   a. The guidelines for research should be sent to all journal editors and to all members of journal review boards.

   b. The LTI was charged with the task of analyzing journal articles according to the guidelines and reporting the results of the study to journal editors.

3. Professionals should adopt the proposed research strategy and criteria. All research in the field should meet the criteria. For example, research carried out as part of degree requirements, applied research in school settings, and university- or clinic-based research should meet the specified criteria. The following two criteria are of utmost importance:

a. Precise specification of the methodology by which the population is selected.

b. Precise, detailed conventional measurement (e.g., precision measurement).

Ways of accomplishing this include:

a. Dissemination of guidelines to DCLD members.

b. Dissemination of the guidelines to heads of training programs.

4. Professionals should develop and publish new research methodologies.

5. The great diversity of published materials on the market for the learning-disability population must be evaluated. Suggestions regarding this include:

a. The appropriate research strategy was outlined by the Seminar (see Question 2 above).

b. A Buros-type journal or yearbook could be prepared to keep teachers abreast of current research findings on materials, techniques, and programs.

6. Training of personnel in this field at all levels should be encouraged.

7. A diversity of backgrounds of students in graduate learning-disability programs should be encouraged.

8. Professional from other fields should be encouraged to carry on basic research applicable to learning disabilities, and this research should meet the proposed criteria. Methods of accomplishing this include:

a. Invite basic researchers to learning-disability conferences, seminars, and symposia.

b. Disseminate the guidelines for research to basic researchers.

PROCEEDINGS OF THE SEMINAR OF SCHOLARS

The next section is a transcription of the four days of meetings of the Seminar of Scholars. Each invited participant presented a short input lecture. Group discussion followed each lecture. The sequence of events in the Seminar is listed below.

Introduction by Corrine Kass

Input Lecture by Charles Strother

Input Lecture by Samuel Kirk

Input Lecture by Barbara Keogh

Input Lecture by Gerald Senf

Input Lecture by Norris Haring

Input Lecture by James Chalfant

Input Lecture by Corrine Kass

Input Lecture by Doris Johnson

Input Lecture by Jeanne McCarthy

Group Discussion

This meeting ranged over several days and a potpourri of topics. Though the proceedings are quite discursive and occasionally rambling, they provide a glimpse of the field of learning disabilities with both its problems and panoply.

INTRODUCTION BY CORRINE E. KASS

Dr. Strother is chairman for the evening but he has asked me to make a few announcements on the rules for the Seminar, so I will take just a few moments. We would prefer not to follow the typical format and go through introductions, etc. You have all been introduced to each other and you will be seeing each other throughout the next few days.

What we would like to do in this Seminar is to have a very fluid type of proceedings in which we would like to ask each participant in turn to be chairman for a particular part of the session. This will probably include some input of your organized view of the field and then a discussion of the input. The chairman then will either call for a volunteer who will take over the chairmanship next in line, appoint someone, or elect someone--whichever you would prefer. You may keep the proceedings moving as you like--if you would like a break, ask the chairman; if you would like lunch, ask the chairman. . .

INPUT LECTURE BY CHARLES STROTHER

In view of the time limit, I'm going to curtail my remarks. I hadn't realized that I was going to be the lead-off man in this ballgame or that my input would come at dinnertime. I might have prepared a little more appropriate introduction at least. If I read the procedure correctly, the input phase is essentially unstructured and processing comes after. So that relieves me a great deal. What I say can be very unstructured, and it's up to you to structure it and up to us collectively to organize it into some kind of output at the end of the conference.

I must say, by way of introduction, that it's not only a pleasure but a real privilege to participate in an occasion like this when you can sit down in distinguished company and have leisure to think about the state of the art in a field that you have been much concerned about, under circumstances where you can be quite informal, where you can be very speculative, where you can go beyond what you know, raise some possibly significant questions and try to indicate what your perception of the field is. That's exactly what I intend to do. I would be hard put to it, frankly, to defend some of the things I'm going to say tonight. I think I could erect a prima facie defense for most of them, but I certainly couldn't prepare a very definitive brief on most of the questions that I want to raise.

Let me, by way of introduction to my thinking about this, indicate some of the immediate antecedents of the way these questions are formulating themselves in my mind. I was invited recently to present a paper at the New York Academy of Science's meeting on minimal brain dysfunction. The plans for that conference were very ambitious. There were three days; there were a large number of papers and it was very multidisciplinary. There were people there from fields ranging from genetics to education, if those define a range, and I was tempted at first to decline. I was tempted because of a great deal of disillusionment about previous discussions of this field.

I sat in, was it ten years ago, in Washington when a large group sat down and tried to discuss the best way of approaching the field of minimal brain dysfunction, out of which grew the three Task Forces of the National Institute of Neurological Diseases and Stroke. I read the reports of those Task Forces very carefully. They came to no conclusion. Task Force One, if you read it, is exactly the same as the report of the English conference which simply said this is a very complex field. There's a great diversity of behaviors encompassed by this term, we don't know anything about the etiology, we can't agree on a uniform approach to diagnosis. So I felt that the upshot of that effort was not to clarify the field appreciably, although the material that was collected was very useful. I think Jim Chalfant's volume was particularly useful in bringing together some points of view and some research data.

Then I sat in, was it two years ago, on the Secretary's Committee on Dyslexia. That was preceded, as you know, by half a dozen other conferences on dyslexia. Each of those preceding conferences said we can't reach any conclusion and finally the San Marcos conference said let's have a national commission appointed that can put the imprint of the United States on a formal conclusion about what dyslexia is, how you define it, and what's the best way of approaching it. We struggled there for a year, as Dr. Haring remembers, with a distinguished multidisciplinary group and came to the same conclusion. You'll find in that report that there is no agreement on dyslexia, whether such a thing exists, how you define it, how you approach it, and so on. So when I received this invitation to the New York Academy meeting, I was hesitant because I felt this would be another three days in which you get together, hash over the same old things, and come out with the same lack of any conclusion.

I was agreeably surprised, and I had not anticipated that I would be surprised in exactly this way. This conference seemed to me to indicate a very considerable amount of progress in communication among the disciplines. What it did principally was to indicate that there was very broad agreement that a classification of children under a single rubric was not productive, that we had better get away from the notion of a simple category of minimal brain dysfunction. Exactly the same thing of course applies to learning disability because I'm using those two terms really synonymously. I think they are synonymous--one's a medical term, one's an educational term, but they encompass the same range of phenomena. Also, it was indicated that the next step must be a definition of homogeneous populations, homogeneous with respect to some significant characteristics and a definition in terms of something that is operational. Now, the lack of an operational definition of what we are talking about (and I don't need to say that to this group) has so confused the literature, has so confused the research in this field that much of the research is simply worthless. You can't compare one study with another because of this lack of operational definitions of the populations that you're dealing with. That's one reason it's confused. [I would like to say as an aside that, although I think it's extremely difficult to do, I think somehow we've got to accept more collective responsibility for the refereeing of articles that go into the journals and papers that are presented at our national meetings. I think that if we had our journals and our programs at our national meetings properly refereed, we would set up certain criteria for every research report, and make it more feasible to compare one with another than is at all possible now. A definition and source from which your population sample was drawn, the criteria by means of which these were defined, the method--well, I don't need to elaborate. I'm sure you're as keenly aware of this as I am.]

The second way in which I think the New York Academy of Service conference made a contribution was in its discussion of proper experimental design in different approaches to the problem primarily of etiology, because that was a medically-dominated conference and physicians are much more interested in the problem of etiology than educators are. It was very interesting to see some of the suggestions for experimental design and experimental strategy in genetic studies, in biochemical studies, in neurophysiological studies, in psychometric studies, in educational studies of the population falling under this broad rubric. I think you will find the collection of papers when they are eventually published a very interesting and stimulating one. I feel, as a result of that experience, a good deal more optimistic than I did before I went into it about what is happening in the field.

With that by way of introduction, I'd like to say something about what seem to me to be some of the trends in the field that I think are potentially fruitful trends. I'd like to start by talking about some trends in psychological diagnosis. It seems to me that there are three approaches to the field of the assessment of the child with learning disabilities--and I'm going to use that term now and abandon "minimal brain dysfunction" because this is an educational discussion.

We have seen, I think, a very definite transition from a focus on classification, i.e., the use of the global IQ (and Sam Kirk talks about this sufficiently in his book), toward diagnostic or analytical psychometrics. And in analytical psychometrics I think we have seen two somewhat different approaches. At least to me they are very different and certainly they have so far produced different but related products. One of these, of course, is the inductive model as represented by its most significant contributor, Guilford--the structure of intellect model. That, as you know, is a factor analytic model which Guilford has been engaged in for almost twenty years and which has resulted in the definition, from his point of view, of 120 categories of mental ability. I want to come back to this a little bit later because I think there are interesting questions that are raised by these different psychometric approaches.

I think the other significant model is the ITPA model, and this is a deductive model. It results from a rational analysis of the processes that are involved in the comprehension and production of linguistic products. I think it is interesting to ask the question--and I'm going to try to ask this a little more sharply later--what are the points of intersection between the models that have been produced by these two very different sorts of approaches, the inductive and the deductive approach to the analysis of psychological function.

There is a second field contributing significantly to our assessment of learning disabilities and that is the field that we may call conventional laboratory experimentation. These contributions are a consequence of several things, I suppose--principally three. One of these is the analysis of specific functions like attention and memory that have come in part from interest in psychopathology (the pathologies of memory, the pathologies of language, and so on), and yet have used traditional experimental psychological methods for an analysis of these particular functions. This type of analysis has made contributions, for example, to the understanding of attention in the retarded, to the understanding of short term memory, and so on.

A second laboratory approach is the developmental analysis of psychological structure and process that is stimulated largely by Piaget's work. Here we refer to an increasingly rich literature attempting to analyze developmentally the structure of cognitive processes and the ways changes in cognitive processes occur. This approach is becoming increasingly important because of the stress on the earlier stages of development. Previously educators were not so concerned about these early stages of development because the school's access to the child started with age six. Now with early childhood development programs the child is entering the educational system earlier and earlier; therefore the educator needs to know more about the developmental processes at stages that are not readily accessible to conventional psychometric approaches but are increasingly accessible to laboratory experimental approaches. For example, the work on learning in infants, the Brown University work by Lipsitt and Siqueland and many other people who are doing this kind of an analysis.

A third major source of contribution to our ability to assess the child with learning disabilities comes from what I would like to term behavioral analysis. I'm speaking now of the approaches that stem from Skinner's work. It's not fair to use the term "behavioral" because obviously the psychometric approach and the laboratory experimental approach involve the observation of behavior. It's not possible to use the term experimental analysis of behavior which is rather conventional in this literature because the experimental analysis of behavior is not exclusive to a Skinnerian approach. So I don't find a very good term, but what I'm referring to here is the Skinnerian approach essentially. It seems to me there have been some very interesting trends here, trends in two directions really. There are trends in the definition of response units and I think Dr. Haring and the people working with him in the definition of the movement cycle are illustrative of this much greater precision in the definition of what is to be the behavioral unit to be observed. If you'll look back to the literature 15 years ago, observational studies were extremely loose because of the inability to define precisely the behavioral phenomena and units with which you were concerning yourself, and, consequently, this was pretty soft data and reliability was extremely difficult to achieve from laboratory to laboratory or from investigator to investigator. A great deal of progress has been made in this direction in the development of the method of defining responses and antecedents and consequences and of quantifying these. This has put not only special education but general education a long way ahead and has really begun to bring it within the realm of science, which I think is a major contribution.

A second contribution, a second development or trend in behavioral analysis is a current interest in much more complex patterns of analysis of the kind of data that are yielded by behavioral observation. It seems to me correct to say that in the early stages of behavioral analysis, the analysis took a very simple form. The focus was on a specific behavior currently being exhibited by the child and an attempt to relate that behavior to certain specified immediate antecedents and certain specified related consequences. The term "related consequences" is chosen deliberately. I mean by this that the application of this method of analysis traditionally was to a child confronted with a task in an immediate psychological situation, and his behavior on that task was then responded to in some way. The concern was with the source and the nature and the scheduling of that reinforcement. In a sense, this is very much the way in which psychotherapy has developed--child psychotherapy. As long as this was dominated by a Freudian point of view and the problems were looked upon as intrapsychic problems within the child, what the therapist did was bring the child into therapy and limit his observations to what happened in the therapeutic situation. He wasn't particularly concerned with relating to the parents; he made no attempt in classical psychotherapy to modify parental behavior. He was modifying somehow the intrapsychic dynamics of the child. The initial Skinnerian analysis of behavior was limited in a somewhat similar way to this immediate situation.

Now we're moving rapidly, technologically and conceptually, toward a much more complex analysis, toward a realization that the child confronted with this task is still embedded in a larger social situation and that this social situation may have components that are significant. The child is also an historical product. Skinner clearly recognizes this because he discusses current behavior in terms of the consequences of all the antecedent experiences of the child. I am saying that the classical application of behavioral analysis to school learning situations has often ignored some of the more remote antecedents in the child's experience. We are now, I think, moving toward a more complex comprehensive systematic analysis of this. If I had time, I'd like to give you some illustrations from our own laboratories of the complexity of interactions that can now be both observed and subjected to a very sophisticated computer analysis. Let me just say this about it. If you're dealing with a dyadic situation, for example, mother and child, or teacher and child; if you look no further than the teacher, the mother, or the child, there are a great many different behaviors that are occurring at a given moment in time. There are both verbal behaviors and nonverbal behaviors in both mother and child. We are now in a position I think to analyze almost the total complex of behaviors that are occurring in both members of this dyadic situation. We can analyze them statistically in such a way that we get patterns and trends much more clearly defined than it has been possible to get if you are proceeding with a rather simplistic unitary approach to the analysis of the problem. I don't mean this critically. I'm simply saying this is a development, a trend. I'm going to talk in a few moments of some similar trends in the application of behavior modification to remediation because I think we've seen a similar shift in the behavior modifier's approach to remediation.

These are some of the changes that I see coming in psychometrics, from the experimental laboratory, and from behavioral analysis that are going to have important implications for the way we approach the analysis of children with learning disabilities. I want in a few moments to try to sharpen that statement and to raise some more specific questions about it, questions that I think suggest ways of looking at the current data, ways of going beyond the current data with new analyses and new approaches.

I should like to turn now to a few observations about similar trends in remediation. Since I've been talking about Skinner, let me begin with what seem to me to be significant trends in behavior modification. You don't have to go back very far in the literature in this field to see the emphasis placed exclusively on the reinforcement of a specified cateogry of responses. But now we're seeing increasing attention in the literature to two other aspects of behavior and increasing use of them in behavior modification. One of these with which you're all familiar is modeling, the effect of modeling, of imitation. Don Baer, for example, has done some of the pioneer work in this area. You find generally among those people who identify themselves as behavior modifiers more emphasis now on the possibility of modifying behavior not through control of the schedule of reinforcement but through the setting up of modeling situations.

I read a statement the other day that surprised me very much. It was a report of a study by Don Baer in which he was talking about an experiment that he and a student of his had done on the effect of instructions on changes in performance. He came to the conclusion that instructions added significantly to the modification of the behavior of the child. This is a new direction, it seems to me, for behavior modification to take which is bringing it closer to cognitive approaches to changes in behavior. I think this is a sign of maturation in the field. Incidentally, after I read that article, I tried it with my own class. I had given the first examination to them without being very specific about what I expected them to know in preparation for that examination. I'd passed out review questions but I hadn't really told them how I'd expected them to go about thinking about those questions and constructing an answer to them. The performance was just terrible. I flunked over half the class. So this last exam, having read Don's article, I gave them pretty explicit instructions on how you prepare for an examination, how you think of these kinds of questions, and how you formulate a fairly precise response to them. The papers were infinitely better--so I believe Don is on to something. We've all known this in a way, but the point is we're beginning to incorporate it into our experimental designs, study it more critically, and then incorporate it more systematically into our remedial efforts. But so much for some of the trends in behavior modification.

I see similar trends in what we might call cognitive training. One of these, of course, is the increasing focus on underlying functions: what are the sorts of functions, sorts of processes that underlie a specific behavioral act? The cognitive approaches to assessment are designed to define what these cognitive factors are, and consequently the remedial efforts are directed toward changes in these underlying functions.

We see also another trend which isn't a very new trend, but it is becoming increasingly utilized, and that is a focus on developmental antecedents. Let me take the structure of intellect and the ITPA as examples of cognitive approaches to analysis. With the structure of intellect approach to assessment, you get a contemporary cross-section of cognitive structure, i.e., you see the way these processes are operating at the moment in the child. You see the same thing from a somewhat different point of view with the ITPA. It is also a contemporaneous description of the functioning of the child with respect to channels, levels, and processes. But there has been an increasing focus, not on current cognitive structures and processes, but on developmental antecedents. This is, in considerable part, attributable to Piaget's influence. Delacato's approach is such [illegible] approach, if you say that one of the developmental antecedents of perceptual discrimination is the development of body image and one of the developmental antecedents of body image is motoric control. Then you begin to approach, as the movigenic curriculum does, as Doman-Delacato do, what are presumed to be the developmental antecedents of the contemporaneous performance of the child. The point of view is taken that you must recapitulate those developmental stages and lay this foundation developmentally before you're ready to move ahead on a contemporary level. I want to comment about that later.

I'm not concerning myself here with a number of other very significant trends in education that you're more familiar with than I, like the trends in curriculum development, the trends in classroom organization, the trends in instructional methodology, the trends in personnel functions, i.e., the defining of new categories of people or the defining of new functions for old categories of people. These are all extremely significant trends but I'm excluding them from my discussion here.

I'd like to come to my last point and make it as brief as I can. In view of these trends, in view of the literature, how can we formulate the questions which have the greatest significance for remedial education, for special education? In what form could those questions be cast so that our search for answers to them is a little bit more precise then it has been in the past, and so that we can differentiate between what constitutes significant relevant research and peripheral or irrelevant study of the infinite range of phenomena that it's possible to study in any field?

These questions are not questions of etiology as far as the educator is concerned. The educator is concerned primarily with modification rather than with etiology. I don't want to depreciate the importance of studies of etiology. I think they are extremely important but I don't think that they're of primary importance to the educator. Genetics, biochemistry, neurophysiology, experimental psychology, and a great many other areas are going to contribute to our understanding of etiology. But the educator is not greatly concerned with this. Nor I hope is he any longer concerned with the problems of classification, of attaching a label to a child, defining a category of children, segregating them, and then utilizing a more or less uniform approach to that particular population. I think we've gone beyond that, there's no point in arguing about it any more, and any one who would defend it is simply--well, let me not prejudge the discussion for, if there is to be a defense to that, I would be very interested in hearing it. Those questions are what do not interest us as educators.

It seems to me that there are two things that we are interested in. I'm not sure that I can formulate these as critically as I would like, but perhaps our discussion will help. If these questions appeal to you as significant, they may be clarified by our interaction as time goes on. It seems to me one of the questions that is primary is: what are the components of an efficient description of the behavior relevant to learning? I have already implied in what I've said about approaches to assessment that we're recognizing that our present approaches are not sufficient to provide us with a description of all of the factors that are involved in the learning situation. Behavior modification is broadening its analysis of interaction and environment. Sam Kirk, in his recent book, said that the ITPA model is incomplete. We have to go beyond that model if we're going to incorporate all of the things that we need to understand if we're working in a remedial situation. The same thing is said also by the people who are approaching this problem from the standpoint of structure of intellect. If you've not read Mary Meeker's book on structure of intellect, I would urge you very strongly to do so. I think in the next few years, it would be extremely fruitful to put Sam's book and Mary Meeker's book along side each other. They are different models of the structure of intellect. And yet, as Sam has written about his model and Meeker and other following in the Guilford tradition have attempted to apply these models to the learning problems of children, they find present models inadequate. I think one of the directions that research needs to take in the future is to ask this question: if you want to use a structure of intellect model, what are the variables that must be included in order to provide an efficient description of the behaviors relevant to learning?

I have included in this statement not only what are the components of a description of behavior relevant to learning but also the word efficient: what are the components of an efficient description? Dale Bryant and I were talking about this question of efficiency at dinner. He was describing his experience with a teaching clinic in a medical school setting which is typical in that it brings together individuals of a large number of disciplines. In our teaching clinic we have eleven different disciplines take a crack at the child and, by the time he gets through, we know a good deal about him. But is that an efficient approach to the problem? How much do you need to know and what's your strategy of arriving at the information that is most efficient, most significant, most fruitful, most utilizable about the particular child? What we're moving toward here, of course, is what we have been using in a sense all the time, the kind of triage approach that medicine uses--a series of successive screens, a very coarse screen that focuses down a little more sharply, then, changing the figure of speech, a little higher power lens on your microscope, then a little higher power lensuntil you can define the fine structure of the child's performance when you need to. But if the pathology is obvious from the initial screening evaluation, then you don't need to go to the expense of all the successive screens that are often involved. I don't want to get over into the problem of teaching students how to do this. There, I think it's very necessary to teach the student to use a whole range of lens that he may need in order to evaluate the gross and fine structure of a specific problem. I think we're going to have to address ourselves to the question of the components and build on the work that's already been done in defining certain components and erecting certain kinds of models, ask how these models interrelate, how they can be expanded and supplemented where necessary, and then how can they be applied efficiently in an actual classroom or clinical situation from a cost-benefit analysis standpoint.

I think, if I can interject this as a kind of aside, that we're going to have to become much more cost-conscious than we have ever been in this field of education--general education, special education, elementary education, university education, delivery of health services--because we're realizing that we simply cannot afford the kind of approach that we have been using. So, a cost-benefit analysis (and I think Jeanne McCarthy's analysis of the cost of her program is the only model that I've been able to find in the literature of a careful cost analysis of what a systematic approach to educational assessment involves) is a very important contribution to the point that I'm trying to make here.

Now then, I think we're going to have to ask a similar question about our approaches to treatment, to remediation. And this question again revolves around the question of efficiency. There are a number of subsidiary questions that are quite important here. It has been clearly demonstrated many times that if you take either a developmental analysis or a contemporaneous analysis of cognitive structure and process, if you focus on some of these processes like perceptual processes, it's perfectly possible to show an improvement in the child, on the basis of systematic training in the particular area of his deficiency. But that isn't the significant question and I think you talk about this quite explicitly in your book, Sam. You say it may not be significant that we can effect a change in the functions we are immediately measuring. What we want to know are what contributions do these changes make to somewhat more remote objectives. In the very recent literature there are a number of quite interesting articles about, for example, Dr. Frostig's remedial approaches.

It has been demonstrated that you can show an improvement on the various items in her test but that these apparently don't relate significantly to improvement in reading at the end of the first grade and have almost a zero relationship by the end of the second grade. I don't think we know the effect of much other training if we're going to use a longer range criterion. Often times we have failed to do two things. We have failed to provide adequate controls. We describe these changes in a given child over time but often describe them without control for the passage of time without intervention. And we have often failed, I think, to carry our longitudinal analysis far enough. We must look not what happens to the Headstart child at the end of the Headstart summer or even at the end of the first grade but follow through and be concerned with all the intervening events, not just what we have done in a deliberate attempt to change him but what kind of a first grade or what kind of a setting has he gone into afterward and to what extent has that affected the maintenance of these gains or the loss of these gains over a period of time. Obviously, until we have a more precise operational definition of the things on which our remedial efforts are going to focus and a more adequate longitudinal analysis of the extent of the effect and the relationship of the effect to the intervention, we're not going to be in a position to evaluate these methods.

Now, I get into the whole question of design of this kind of research and the complexity of that design and the extreme difficulty in adequately controlling all the variables that enter in. Equal ability, for example, or adequate definition of the method that's being used, control of the materials, of the time factor, of the training of the intervener, all these familiar problems that have plagued educational research that is directed toward the relative efficiency of different methods or even, if not toward relative efficiency, the absolute efficiency of a specific method.

These seem to me are some of the significant trends, some of the signficant questions that arise from these trends, and some of the problems that we've got to grapple with if our research in the next five or ten years is going to be as productive as it can be and hopefully much less confused than our research products from the last ten years.

INPUT LECTURE BY SAMUEL A. KIRK

This morning I'll free associate about a few things that have been bothering me, hoping that they might also bother you.

In 1946, I got a call from Mr. Graham, director of special education in Illinois. He asked me to meet him in Chicago because he was a new director of special education and was having all kinds of problems. He said that the subsidies for mentally retarded children in public schools assisted many schools in organizing special classes, which became dumping grounds for all the problems of regular grade teachers (behavior problems, etc.). He wanted to find out how he could restrict these classes to children who could be properly classified as mentally retarded and who require that kind of a special curriculum.

I have always remembered that conversation since we initiated the area of learning disabilities. My guess is that learning disabilities, like the field of the mentally retarded, has become the dumping ground for all the problems of the regular teachers in the schools and I think this is also being fostered by many of our state programs because we have not yet asked the proper question of who these children are.

The second point that I would like to mention is that it's easier to work with minor problems than it is with severe problems. I think the best example is the field of speech correction. The surveys made in speech correction show that 80% of the clientele of a speech correctionist consists of children with articulation disorders and most of them are in the first and second grades.

This practice resulted in legislators introducing bills into the legislature in Illinois asking for a subsidy for aphasic children. We thought that that was a problem for the speech correctionist. But we found out a speech correctionist did not have the time to take on severe cases because the state required her to serve 100-150 children. To do that, she had to have 5 or 6 in a small class and take one child for 10 minutes a week to correct an articulatory disability like a lateral lisp. Maybe this is an exaggeration. But I know that to take an aphasic child that requires an hour a day, 5 days a week, would tend to reduce the speech correctionist's load below 100. The regulation required that a speech correctionist had to have at least 100 cases in her workload in order for the state to pay. What I'm trying to say is that maybe we're doing the same in the field of learning disabilities. We're concentrating a great deal on the very minor problems because we can handle them in the regular grades and with little effort by supplying a little material or something of that sort to the regular teacher. I'm just raising this issue as a question. Is it easier to handle the minor cases than to serve the severe cases that are going to take a lot of time.

At our last meeting with the state program representatives, I tried to raise the question of defining the kinds of kids we are working with. And I'm not sure we succeeded in getting an answer.

As I see it, what's happening around the country is that we're either making observations or we're giving tests to identify children with learning disabilities. If we give educational tests, we find that 20% of the children have learning disabilities. Wherever we go, they tell us that they have found 18% or 20% learning disabilities in their population. They are usually talking about a one standard deviation discrepance in a group, and that generally amounts to 17% of the children in a group. If we give an IQ test and take one standard deviation of 84 and below, we get 17%. So I am raising the question of whether we're just talking about 17% of the school population as the LD group. Rick Heber, several years ago, tried to define mental retardation as one standard deviation and below. That criterion would result in 17% being mentally retarded. The recent court cases in California, and in Arizona, by the way, resulted in a court ordering a school system to use a two standard deviation IQ cut-off, which means 68 IQ or below for placement in special classes.

So I raise the question of whether we're talking about the minus one standard deviation as the criterion for learning disabilities or whether we really are looking at problems. If you give a reading test to a school population, you are going to get 20% at the lower end of the distribution, i.e., below one SD. But we also obtain 17% as slow learners (70-80 IQ). If we measure that group educationally, they are going to be a year or so retarded educationally. And I again ask the question of how many of these children that we're calling learning disabilities are really slow learners or retarded educationally for reasons other than a specific learning disability. I'm sure that many of the children classified as slow learners are learning disabilities cases. But, I don't think all of them are.

In the field of the mentally retarded, there has been a backlash. At first the IQ criterion for special classes was 69 and below. But they kept raising the IQ level and having more and more classes, including the culturally deprived and learning disabilities in these classes. But recently it has backfired on them. The minority groups have objected to classifying so many of their children as mentally retarded. And the minority groups were right. There was not that kind of a percentage of mental retardation among minority groups. I suspect that in the field of learning disabilities we are eventually going to get a backlash. The regular classroom teacher will always like to remove problem kids from her class or obtain additional help, whether these children have learning disabilities or not. They could be behavior problem children, slow learners, or what have you.

How many of the so-called LD children are cases of corrective reading? I don't know if this is a good classification or not, but I divide reading into developmental reading, corrective reading, and remedial reading. All of these are arbitrary classifications, but they can be defined operationally in some way. We have said that if a child doesn't learn to read according to the developmental methods used by that school, then we should try corrective reading. Most of the remedial reading teachers that are in the schools are corrective reading teachers. I like to define corrective reading as symptomatic training of a child in reading or improving his reading ability which is slightly retarded due to lack of motivation or poor instruction or getting lost in a big class. There is nothing really wrong with the child. So what you do is help him out with the proper method, you program it a little better, you correct some of his errors, you do a little concert reading with him, etc.

The remedial reading case in my definition is a child who has not learned to read, not because of lack of instruction or getting lost in the situation, but because there is some major disability within the child that has inhibited his learning to read by the ordinary methods of instruction used in class. This is my definition of a remedial reading case. If we can find something in the child that has tended to inhibit his learning to read, we are on firmer ground. We can observe his psychological disabilities, not necessarily biological (although we can always argue that there may be a biological base for his inability), but we can observe it behaviorally and that's as far as we can go in most cases. A simple example is a sound blending disability. There is no use trying to explain it biologically as Smith does (a result of acetylcholine-cholinesterase imbalance of synaptic transmission). We can train a child in sound blending and correct and help him learn to read. Or the child may have a visualization deficit. I like to call these disabilities correlates of learning disabilities. The question is how many children do we have in school that really have something wrong with them, have a correlated disability to their reading disability. I don't know what the percentage is, but I'm sure it is not 20%. But we may get 20% corrective reading in some schools. The question I like to raise is whether we should confine learning disabilities to major problems with psychological (or possibly biological) deficits. And, are we calling corrective reading problems learning disabilities, and hence increasing the prevalence. We should always ask the question of whether we are dealing with corrective reading problems and whether we need high-powered specialists for these problems.

Another thing I'm concerned about is the so-called multiplier effect. We're falling in the same rut of serving more and more kids in a superficial way. It seems to me that what we need in a demonstration program is an accurate, quality approach to the problem with a few kids. Then, we can take a look at it and ask the question of how can we do a quality job for a lot of children. We should not start out with the idea of the multiplier effect as the main reason for existence. We start out with ten kids and next week they want logarithmic progression. We are pushed from the U. S. Office and by the State to demonstrate service to a great number of kids. Many times the procedure is completely superficial.

A major problem I should like to mention is related to training, service, and research. I'm a little bit concerned about the trend of events in which we have within the Office of Education a research division, a training division, and a service devision. I'm concerned about the divisions between these and the lack of integration of operation within the field as a result of the breakup of training, research, and service. One of the big arguments that we had for the establishment of a Bureau for Handicapped Children in the Office of Education was that of integration of training, service, and research. As it stands now, learning disabilities has fallen completely under the service division of BEH. The research people, I think, have pulled out. At least, I don't see them around very often. And the training people have very little to do with the service. The awarding of training grants to colleges under block funding has nothing to do with the service operation. So we have become bifurcated at the federal level and, as a result, we're becoming split at the service, research, and training levels. To me, these ought to be one operation. I have for many years advocated that fact that what we need are integrated units that conduct service, training, and research. It's being done in a few places in the United States, but I think it should be done in many more places. This unit can be used to give service, train students, and conduct research. It can also give consultation and technical assistance to local and state programs.

My last comment will be on research. I'm taking a look at trends in new methods in research. I do not believe that we can do very much nomothetic research, i.e., setting up control groups, randomizing them, treating one group and not treating another, etc. in our present state of knowledge. It is difficult to use control groups on LD children. How can you match kids with a disability? For example, I found a four-year-old child in a school for trainable children who had a chromosomal translocation and was diagnosed as Mongoloid. On the ITPA he was testing at the six-year-level on visual tests, was not talking, and tested below two on the auditory-vocal tests. But he was not mentally retarded. Suppose I wanted to conduct an experiment on how to train children who have chromosomal translocations, who are age 4, who are diagnosed as Mongoloid, and who are not talking. How can I find a group of such children, randomize them, treat one group, and leave the other group for a control. This is impossible. Many of our learning disability cases (I like to classify this boy more as a learning disability rather than mentally retarded) are difficult to match. We can bluff with control groups and matched cases and obtain significance levels of .05, etc. But how much can you transfer that knowledge to clinical work?

In these rare cases, we really need to use one kid as his own control. We might call it idiographic research or case studies. These procedures may give us insights into the learning processes of children with different disabilities. I was impressed many years ago by a little article written by Dr. Shapiro in England, even before Skinner got popular with this kind of approach. He stated that we can derive laws of behavior that may be more valid from the study of single cases. We may understand the learning process a lot better if we look at one person. This is now being done a great deal in experimental analysis of behavior and by followers of Skinner. I think that at this particular time it is my preferred approach to research, if we do it right. But I think we have to do it right and not just teach a child and say he has made progress. We have to know exactly what we're doing, what changes are being made, etc. We have to program our instruction in such a way that we know exactly what we're doing and can measure it in some way.

I said research was my last point, but I wish to comment a little bit on training. How do we train people? We tend to give them courses on learning disabilities, theories of learning disabilities, behavior modification, a course in teaching the kinesthetic method or the phonic method or training visual memory, or what have you. I am not sure, but I think that most of us in the field find that we are not really training people. I think that most people desiring training want a little cookbook to use.

How do we train people to assess a child, to look at him, to see what he needs, and to invent for that particular kid a procedure for him to learn. Most of the cases we've had, we've had to invent the method of remediation. For each child with a specific and unique problem, we have no ready, prepared method. We may use part of one procedure or part of another, but we have to invent the method. The question of training is, therefore, how do we train students to invent different methods for different kids? This is, I think, the basis of training and the procedure in training in which we are failing. Maybe invent is not the right term. Maybe it should be create. If this is the problem, then how are we training students to invent or create the right method for a particular child. I don't think that we're training them to be creative. Instead we let them look at this method or at that method. Who developed the particular methods that we use. Who invented some of the procedures we have and where did they get the ideas to invent, to design, to create. They probably got them from principles of learning or principles of putting things together in some way.

I remember at one time when Gallagher and I were going to organize a program for brain-injured children at the institution for the mentally retarded. We hired one girl with a master's degree in special education and two Ph.D.'s who had specialized in learning. The only one who knew how to teach was the girl with the master's degree in special education. The two Ph.D.'s couldn't apply their theoretical knowledge of learning to the problems of children. They knew Hull, Guthrie, and Tolman forwards and backwards. They had all the theory they needed but they made all the mistakes a high school student would make in teaching. Knowing what Hull and Tolman said appeared not to be applicable. In short, theoretical courses in learning may not train people to invent. We will have to develop methods of education of people in learning disabilities in such a way that they will be able to design, invent, create a particular approach for a particular situation. And without that ability we will have a group of mechanics that have studied how to teach phonics or the kinesthetic method or some other method and who apply it to every kid regardless of his disability. I think that is about all I have to say.

STROTHER: Well, we're supposed to have time for discussion, Sam. I've got some questions.

KIRK: Okay, it's open for discussion. Not only my iconoclastic remarks this morning, but also Dr. Strother's very brilliant presentation is open for discussion.

STROTHER: I'd like to raise a couple of questions. From your criticism of a statistical definition of learning disability and your later comment about something wrong in the child, I gather you're taking the position that the difference is a qualitative and not a quantitative one. And so the question that I'd like to raise is how you would suggest getting at the qualitative difference?

KIRK: I'm not sure that I would say it's completely qualitative, although partly, but it's also quantitative. If we were to analyze a child, I would ask the question of discrepancies in growth or extent of intraindividual differences within a child as one definition of qualitative differences. But the answer would be also partly quantitative since we determine the extent of the discrepancy within the child in quantitative terms. We also determine where his abilities lie since we have to have abilities and disabilities in a learning disability child to differentiate him from a child who has no special abilities or disabilities. If all abilities are low, I would classify the child as mentally retarded, if we use classification at all. Everytime we try to measure qualitative differences, we get into a quantitative measurement of some sort. I'm not sure that I can answer that question. Do you want to comment on your own question?

STROTHER: Well, I think that I would probably say the same thing you've said, although I'm not exactly sure of it. If we look at the history of disturbances of function of adults as a result of central nervous system damage, we do see clear illustrations of qualitative differences. And I think we have to entertain the hypothesis that such differences also exist in children. You've suggested the way to get at these differences, at least implicitly, when you were talking about the child who could not make a sound discrimination. It may be that we're able to identify tasks that the child is unable to do. But I'm speaking hesitantly here because, once we say he's unable to do it, we admit that we can't do anything about that inability except circumvent it in some way.

SENF: Why is that? Why does that necessarily imply that we can't do anything about it if you call it a disability?

STROTHER: No, I said unable to do and by that I mean constitutionally unable to do. That's what I guess wasn't explicit.

KIRK: Another angle to the question relates to brain function. Everybody knows I don't like to talk about brain function because we can't get at it except hypothetically. But it's my impression that a child that has some sort of physiological limitation to performance tends to withdraw from the activities on which he is uncomfortable. What he tends to do is to withdraw from that particular situation and reacts to those situations on which he gets reinforced or has success. This particular child tends to practice the things he can do and withdraws from the things that are uncomfortable for him to do. The mother does the same thing with him. She shows him off on the things he can do and avoids the things he can't do. Teachers also tend to do the same thing. They tend to have the child do the things he can do and avoid the things he cannot do. When we diagnose this child later, we find wide discrepancies in his abilities. He can do some things well and can't do other things. To say that he cannot perform because he has brain damage may not be correct. It may be only a partial answer. The other partial answer is psychological, namely, that he has withdrawn from this particular activity during the growing stages. Remediation has to fill in what should have been filled in if he were developing normally. There may be a limitation to what you can do with the child in a particular area. But it is our duty to use remediation to elevate the area on which he has withdrawn for many years.

KEOGH: I'm bothered, as I think the qualitative-quantitative question is a critical one. We've been wrestling with it for years and it hasn't gotten us very far. In our search for qualitative differences, we make implicit assumptions that certain children are different, are part of a noncontinuous distribution. Yet, you've indicated that LD children respond within the parameters of a continuous distribution. It seems to me that those things are not necessarily compatible. We may say that a child is "qualitatively" different to the point that he has some kind of in-child, disabling condition which precludes certain developments, i.e., he is brain-damaged, neurologically impaired, dyslexic. If so, I think you cannot make the next statement, that the reasons for his school problems are that his parents and teachers did not allow him to be in situations of having to cope with those disabilities. I find it impossible to conceive of noncontinuous distribution. I do not see learning disability children as being "a different kind of animal" from other children. They are subject to the same laws of learning and go through the same developmental periods as do other children. I'm bothered by the in-child deficit, qualitative emphasis in LD research. In my opinion it has been wasteful.

STROTHER: Yes, I think that's true. But on the other hand, suppose you take the case of the blind child or the deaf child. You can say this is a quantitative difference in visual acuity or auditory acuity, yet qualitatively there are some differences in the cognitive development of the deaf, for example. So I wonder if. . .

KEOGH: But are outcome differences explainable in terms of the same kinds of theoretical parameters that define other kinds of learning for hearing children?

STROTHER: Yes, but I think that's a different question.

KEOGH: Yes, it is a different question, but I think the two often get very confounded and this is why I wanted to pull it out.

KIRK: Maybe I don't understand the problem of qualitative and quantitative differences. What I tried to emphasize was that a child may not develop motor coordination because of some physiological disability, plus avoidance of some behavior and compensation with others. The child I referred to had verbal diarrhea; she talked, talked, talked, but she didn't do anything. We have a lot of those kids. Then we find out we can teach them to do a lot of things they have previously avoided because it was uncomfortable for them to perform. We also have children who are hyperkinetic and show a lot of physical movement, but do not talk. When these children get older they have a wider discrepancy between what they can do and what they can't do. I define learning disabilities that way, discrepancies in growth. That is why I say we use the assets to train the deficits because they have it within them to develop according to the laws of learning. We are assuming that they just weren't put in the situation to get reinforced for performing in one area but got reinforced for doing the other things.

For some children it is possible to get great progress up to a certain point. In some cases there is a limitation to their development in a particular area. I like to justify remediation, not as developing cortical cells or correcting brain damage or straightening out acetylcholine-cholinesterase balance, but rather filling in psychologically what should have been filled in earlier if the child had an opportunity to learn, and was reinforced for his behavior.

HARING: From a practical standpoint, the point you raise is a significant one. And that is that a lot of the critical functions relating to the academic areas can be significantly modified even in the seriously-involved child. Even with the most precise teaching that we have--applying good sequencing of cues, good reinforcement principles, some children will not reach the level of functioning in certain areas of performance (say word, or say number, write number) where it would be functionally important for them to use it. It's not a function that they can perform in spite of the best methods we use. Now, these children are kind of rare, at least those children who are identified simply as learning disability kids. They're very rare. I think maybe 1 out of every 100 that you begin working with will not be able to perform and use that skill functionally. So that one of the things it seems in defining quality is defining quality in terms of function and then, taking it further, and defining kinds of things we do from day to day or we expect children and youths to do from day to day. Find out what is the minimal level of performance on these particular skills a child must have to use that skill effectively. So if we kept going like this, following a kind of linear relationship with our logic, we could get points that would give teachers a desired rate or a desired level of performance and we may not even have to get involved in the quality issue. We get involved in the quality issue and it gets messy because of the difficulty in definition. You [Strother] define it in terms of the associations the child doesn't build because he doesn't have a sensory avenue. Anyway, that was only one example, you'd have many better ones than that, of course.

JOHNSON: I think perhaps shift from "qualitative" to "quantitative" descriptions if we were to describe behaviors more specifically. It seems that one of our tasks is to delineate the behaviors much more precisely and not overgeneralize. For example, before stating that a child has a disturbance in visual perception, we need to study his ability to compare and contrast information from all sensory systems. Similarly, we would need to define the type of content that can or cannot perceive. One might, for example, use Guilford's model. We have found some youngsters can perceive figural but not semantic information; others show the reverse pattern. In other words, I think we can eliminate some of the so-called qualitative factors from our clinical descriptions by refining the parameters of behavior that we study.

KIRK: And the retarded child has that too.

JOHNSON: There are some issues pertaining to remediation that also must be considered. Frequently I think one sees remedial approaches that apply a "fill-in" technique. Thus, if a child is poor in auditory or visual perception he is given exercises for that deficit. It seems that we need to investigate the ways in which a processing deficit affects various aspects of learning such as reading, spelling, or mathematics. For example, some children have minor disturbances in one sensory modality but may overcompensate for the deficit by utilizing integrities from other sensory systems. Certain children with auditory perceptual problems have no problems in reading if visual skills are very high. Therefore, in planning remediation, one must look not only at what is "down" but at those things which are "up". Instead of taking a "fill-in" approach, one must try to create a balance in the total cognitive processing.

CHALFANT: I'd like to follow up this comment. I'm not sure how people define qualitative difference. When someone says qualitative difference, in my mind I automatically say cognitive style, learning style. And I think everybody is qualitatively different from everybody else. I think your mental abilities are different than mine. When children in school, are referred for problems, they're usually failing in some kind of academic task, some sort of a functional performance. We test the individual psychological processes (such as we think them to be) and find deficits such as Doris has described. We must look at the entire learning style of the child, which goes back to your point of looking at psychological assets and deficits and their interaction. In giving the visual memory-for-design test we find people who have absolutely no visual memory for designs at all, who pass that test by verbal mediators. They use their other processes to pass that test. The tests can mislead us. In answer to Dr. Strother's question, "How do you study quality?", I think what we have to do is develop a system for studying the learning style and the dynamics of the thinking processes. A teacher, if she can make some pretty good assumptions about how a child learns, knows something about psychological processes and can pay attention to the physical stimulus cues which are presented. What processes are easily remediable and which processes are more difficult to teach? For example, automatic-sequential skills seem to be very difficult as opposed to representational type concent. I think what we have to do is to develop a technology to get at the learning style of children.

JOHNSON: And not only in relation to academic learning. I think that's a bit of a hang-up right now in studying the children. Social learning and the nonverbal learning are as critical as academic achievement. We need to look not only at predictors for academic achievement, but predictors for all learning, including social skills. . .

KEOGH: Could I just comment a moment about Jim's statement? I think we would all be in agreement that there are qualitative differences in learning styles and that we need to be more sensitive to matching instructional programs to maximize those differences. I am responding to a different kind of interpretation of "qualitative" and I'd like to come back to it for just a moment. The search has been for the definition of clear-cut kinds of qualitative syndromes, minimal brain dysfunction or hyperkinesis, or others. The assumption is, that on the basis of behaviors and achievements (i.e. symptoms) in the elementary age period, a child fits into a particular syndrome, and that he is qualitatively different from a child who fits another set of symptoms. This has led us down a rather fruitless path, because it is clear that many of the symptoms are correlates, that they are overlapping and they are nondefinitive. Although the qualitative question is a very intriguing one on an intuitive level, I'm not convinced there's much evidence to support its diagnostic or remedial value.

CHALFANT: Well, the combinations and permutations of possibilities are so diverse that it's very difficult to be definitive about qualitative differences in cognitive style. For example, I'd always assumed that children with language problems also had conceptual problems. Recently, I have been finding children with a poor language system but who have the ability to abstract conceptually. I believe a child who has conceptual problems may or may not have a language problem, and a child who has a language problem does not necessarily have certain kind of conceptual problems. In terms of academics, I think people are focusing on school skills and not on the processes which underlie academics, such as the ability to move from the concrete to the abstract.

STROTHER: Well, I don't want to leave this question of qualitative versus quantitative without taking another line of attack that stems really from Sam's comment about the necessity for idiographic rather than nomethetic research designs. I've been associated with medical schools long enough to be heavily influenced by a biological point of view. And if you look at the history of medical literature 50 years ago or even 30 years ago, a large quantity of that was individual case reports or a small group of cases that seemed to the individual to have similar characteristics, to constitute a syndrome, to belong to a particular category. Medicine got a long way by that line of approach. But now, in the last 30 or 40 years, they have begun to identify the basic physiological and biochemical and morphological factors that are involved. So that now when they look at a patient, they aren't saying what is this person as a whole person, but let's look at a biochemical assay of his blood and identify a specific characteristic there and then apply the treatment to that characteristic. And we can find a lot of other patients who show a lot of other individual differences, are clearly different from this person who has the same characteristic and whom we need to treat in this same way.

SENF: But that biochemical assay is really done to make some predictive statement about some disease entity that is. . .

STROTHER: Also postdictive about etiology and pathology.

SENF: But analysis, say, of urine, isn't accomplished to isolate some urinary disorder, but really to indicate the presence of another disorder signalled by irregularities in the urine. So they are still seeking categories of disorder.

JOHNSON: And, again, relationships between systems.

SENF: It is disorders in specific systems that are being sought, basically it's not an abandonment of categorization.

STROTHER: That's right. Not categories of people, but categories of disabilities within these people.

KIRK: I wasn't quite sure, Chuck, what you were commenting on. I understand that you said that medicine first did case studies and then went into other kinds of research. I was saying that at our stage of development, we'd get more paydirt out of the case study idiographic research, using the individual as his own control, and so forth, than if we jumped into nomothetic research without knowing the ingredients very well. I wonder if you were contradicting that or going along with it.

STROTHER: No, what I'm simply suggesting that maybe we're in the same stage that medicine was about 40 or 50 years ago and we ought not to abandon the search yet for ultimate basic factors that we can deal with predictively, preventively, therapeutically. That's all I'm saying, Sam. I agree with your strategy.

BRYANT: Well, this is very similar to an approach where basically you could either cluster individuals or you can try to do a factor analysis getting down to what are the underlying components. And the extent to which you can analyze and break down depends upon just how much basic knowledge we have of the basic processes. Maybe it is through looking at clusters--both you and Sam mentioned this, not taking L.D. as a whole, and I think you used the term of homogeneous populations--maybe we have to start with individual cases which have a great deal in common and we begin to see things in common about them. But eventually we're going to have to get to an analysis of the underlying components, so that we can define those clusters. We may find a cluster that might be like, in psychometric terms, an arithmetic reasoning which can be quite adequately taken care of by two other factors, a numerical factor and a reasoning factor. And so it really is an artifact of the things being put together.

HARING: It is painful to continue to look at children one at a time under carefully controlled conditions. Carefully controlled conditions are at least the application of experimental analysis of behavior. That may not be the only one, but it's a practical one for us to use now. This reveals, if you look at 200 or 300 analyses of say sound behaviors (the children say sounds), different rates and different errors. Pooling all of these children with some computer storage procedure will yield certain kids with very exact performance characteristics. But you wouldn't find them in the city of Seattle or the city of Los Angeles or Kansas City. You would find these characteristics after you pooled several thousand kids. It's impractical to think that a teacher with 25 kids could group in any meaningful way 5 kids if these kids had disabilities that were affecting their performance. So that, this is a fruitful line and I want to make sure that it doesn't get concealed at this point. It marks a step in progress in our study of kids with learning problems.

KIRK: This is a little bit of a sideline, but Herb Quay and somebody else and Richmond Paine at the Memorial Hospital in Washington were studying brain-injured children that came to the hospital. They gave all of them different tests, the ITPA, the WISC, and observations of various kinds. They made a factor analysis and couldn't find anything. Nothing grouped. I wondered why the children who were diagnosed by neurologists as receptive aphasics did not group with children having low scores on the auditory reception test of the ITPA. We found that only three cases out of those 125 were diagnosed as receptive aphasia. That is why the thing washes out. They had too few cases in some of the categories to show significant correlations, hence no results of any significance from factor analysis.

SENF: But it's not the factor analysis that's wrong. It's that they put in garbage and they got out garbage, called "gigo" by computer buffs. It's not the technique that was wrong but that it was inappropriately applied.

KIRK: Well, this is what is happening so many times. They shove some data in a computer and get a factor analysis out, then report it.

CHALFANT: Statistically we're trying to measure a few mice in a box full of elephants. These kids are few and far between.

KASS: There's also the case for intuitive, educated guesses. There's always two sides to the coin. One side is that you can make a theory regarding these children, another is looking at the statistical information, both of which may be used in dealing with n-of-1 or any other research methodology. I wouldn't want us to throw away the thoughts which might go into a framework.

BRYANT: I'm interested in these mice in the cage full of elephants. Sam's original point was the relatively large number of mice that are being identified. It may well be that when you really try to look at homogeneous groups or subgroups that you're getting into very small numbers. But I wonder if it isn't really more like different varieties of mice all mixed in together. There's certainly a great many children with similar symptoms, though it may well be that the functions that go to make up the symptoms are quite different for different ones.

STROTHER: I don't like to follow these mice because they might lead into schizophrenia, but your comment about factor analysis leads me to think about this a little differently than I had before. You know if you take factor analytic procedure and you start with test performances, it seems to me that from an operant approach you're saying that's the level at which we should work. We should look at the way the child performs on this task and then modify his performance on this task. Then what others are saying is that we should perform a factor analysis on this and extract some first order factors and then we should deal with these first order factors. But you know we can also carry it a step further and get second order factors and third order factors and say we should address ourselves to this second order factor or the third order factor in order to bring about the most efficient result. And ultimately, I guess we've all got to submit ourselves to the test of efficiency, to say, suppose we work at each of these levels, at which level can we produce the results that we agree on are appropriate criteria.

HARING: There're two reasons why factorial design would not control for the extent of variance you'd like to have, so that we'd have very little prediction. One is the thing that Sam referred to that their performances are canceling each other out. And the other is poor measurement and also the inference you make about the performance or action you're measuring. But no matter what you do if you give a Binet and an ITPA, the language portions of the ITPA and the Binet will. . .It's so powerful that it'll control for say 20 or 30% of the variance and the rest of the tests won't do much. That's one of the problems of throwing in those two measures. They're too closely related. That's not a fruitful, productive area. We've found that out.

KIRK: In terms of what Doris mentioned, that a lot of good readers can't sound blend, I should like to mention that the human organism fortunately is adaptive. We take deaf children who can't sound blend or even hear the sounds, and yet we can teach them to read. But they have to have some other ability at a high level to learn. When I find a kid with a very high IQ that hasn't learned to read, I look for multiple disabilities. For example, he may have a sound blending disability and a visualization disability. If he had only one of these disabilities he might be able to learn, using the other ability. That is why one child appears to be retarded in one area and can't read, while another child similarly retarded in reading does not show the same disability.

JOHNSON: I also believe that underexpectancy and lack of instruction are additional compounding factors. Often one sees children who are underachieving in reading but they have only minor processing deficits. A review of the educational history indicates that after a certain point, the child had very little instruction. People gave up trying to teach him. Thus, the underachievement is greater than one would expect.

Also, I feel we need much more comprehensive diagnostic studies of children. Many of the assessment tools are too narrow; we are not studying whole processing systems. We need to study the entire visual or auditory system, and the interrelationships between the two.

CHALFANT: One reason for that is that people did not know really what the whole auditory processing system is. In trying to get ready for this symposium, after a couple of days it occurred to me that where we are is that we're really a field without a methodology and without a technology. And that's really what needs to be done more than anything else. And the suggestions and comments that Dr. Strother and Dr. Kirk have made so far have time and again hit the lack of methodology and lack of technology. And unless we come up with methodology and technology, the work will never be accomplished.

SENF: Methodology to do what?

CHALFANT: Methodology for design would be one example. In response to Dr. Strother's question, "How are you going to get at learning style?", I have a few procedures I use which are unpublished. Perhaps someone else has other procedures. We haven't created, gathered together, or published many effective procedures for teachers. We're at a very primitive stage in the field--and then the U.S. Office of Education comes along and says multiply your present status of development.

JOHNSON: My thoughts over the week have been the same. Consider the methodology for gathering your data in the area of language disorders. As one looks at the psycholinguistic methods, and our heterogeneous population, we have to try various sampling procedures. In some instances we may use the corpus technique, gathering large samples of language. At other times we may study specific features such as plurals or pronoun usage.

We also need to gather the data in various settings. For example, the language output heard at home may be different from that in the nursery school or the remedial clinic. In this way we can begin to look at the interaction effects of the disability and the environment.

CHALFANT: The area of behavior modification, operant learning caught fire. They have literature because they have a methodology. They have a system that people can read and understand and apply. In our area, we do not have a comparable system and until we do, we will have neither good literature, nor good research. I think the suggestions of our speakers and the group so far are directed toward what kinds of methodology we need.

INPUT LECTURE BY BARBARA KEOGH

I will rearrange my remarks in light of the previous discussion. First, let me say I think we've been talking of two levels. One has to do with what are the kinds of theoretical questions that need to be addressed. The second has to do with _application_ of some of the partial knowledge we have in terms of those questions. This may account in part for some of the dissonance in the discussion.

I am not as optimistic as you, Dr. Strother, in that I feel we have not made substantial progress in the pursuit of basic questions over the last 10 to 15 year period. We have been so involved in applications, in responding to the immediate crises that occur in school systems, in individual families, with individual children, that we have neglected the search for the underlying critical variables. The field is characterized by lack of a substantive body of information which can provide the basis for a variety of remedial programs. To put it another way, I think we know little more now about the learning and behavior of LD children, and the interventions that are critical than we knew when we started. I would view this search as high priority.

SENF: When you say, "We know little more than when we started," do you refer to the broad field of social science or to learning disability specifically?

KEOGH: I'm trying to restrict my remarks to the field of learning disabilities. I agree there have been substantial gains in terms of inputs from other fields, but in terms of learning disabilities _per se_, we are still at a level which confuses remedial applications with some sort of a half-determined "basic data." This reflects in part the kind of thing we talked about earlier in terms of qualitative-quantitative differences. We are uncertain as to what are the critical parameters of learning disabilities in children and how these interact with the situational variables which affect learning. It is that interaction between child characteristics and situational characteristics which for me constitutes the basic question in the field.

I'd like to expand on that for just a moment. A number of people have come to the learning disabilities field with training in psychology where emphasis has been on the experimental paradigm, where the design has been to reduce the amount of subject variance, to allow the manipulation of specific, predefined variables. We have attempted to apply that paradigm to research in learning disabilities; we have been, for the most part, notably unsuccessful in the effort. One reason we have been unsuccessful is that we are yet uncertain as to what are those parameters or variables which we are attempting to manipulate; another reason is the marked heterogeneity of our subjects. A result of our confusion has been an overconcern with techniques of identification and an emphasis on methods of categorization or placement. If you look at psychodiagnostic techniques for the last 10-15 years, as applied to learning disability children, they have been almost exclusively quantitative in emphasis; they have focused on traditional cognitive variables; and, they have provided summarizing numbers appropriate for categorization. They have, for the most part, _not_ led us to an analysis of how children learn, what are the processes which are implicated in disturbance, or what are the situational variables which might be effects of influence. Our efforts have been expended almost exclusively on programs and on methodology, often without benefit of substantive knowledge which could provide a basis for such programmatic development.

The problem in part relates to the definitional question which has plagued us all. In my opinion, we have spent too much time and effort trying to tease out a "specific learning disabilities syndrome." We have spent too much time getting at what are qualitative correlates which presumably make up such a syndrome. These correlates have proved to be overlapping, non-specific, and unreliable. I would like to make the point of view that we are concerned with the large number of children who have serious problems in school learning, including Sam's 17% at the end of distribution as well as the 1 or 2% who have definitive "hard" signs. Exclusive focus on the 1 or 2% who represent some kind of "specific disability" is inefficient, and doesn't really get at the practical problems of the number of children who have serious difficulty in school learning. It also means that most of our efforts go into diagnostic, i.e. selection and exclusion practices. I support vigorously a broader definition of learning disabilities.

Related to the definitional question is an assumption with which I am very uneasy: that is, that if we are able to come up with a specific kind of diagnosis for a specific kind of in-child condition, we will be able to provide an appropriate, specific kind of remedial response. If that is true, as it is in medicine where diagnosis determines treatment, then that's fine. But in the present state of the art, I suspect that a "good" diagnosis, does not necessarily direct our remedial programs in specific ways. As a consequence, although time and effort get put into diagnosis, at the end of the time we don't know a lot more about how to deal with the child than we knew when we began. So again I come back to my initial point that our concern has to be with identification of the characteristics that may give direction in remedial programming.

The remedial question is compounded in that each of us in his heart probably feels that there is a particular method of remediation that is best. Most teachers seek a "single best method." I think that is an impossibility My guess is that the really good teacher is the one who has available a number of strategies, and that he can switch off very easily one to the next. In contrast, what usually happens is that the teacher faces a classroom of children, presents his material, and fortunately, about two-thirds of the children learn the first few times around. When dealing with that other third who don't learn, the teacher does the same thing over again; a few more learn with some repetition. That still leaves a few children floundering. The teacher now gets a little cross, raises his voice, and says the same thing over again, louder. We get repetition, with a lot of affect, of the same kind of technique and material. It seems entirely possible that the child who does not learn under one system might very well learn with a different instructional system. I would argue for a multiplicity of instructional strategies available in the same learning situation. I would argue for getting away from a search for some kind of "single best method", in order to maximize a possible child-system matching through a variety of methods.

Returning to the original charge to this meeting, I view a major kind of problem the definitional one, but I would support a broader definition of learning disabilities, not a more limited one. I would support a more educationally functional definition rather than one that focuses exclusively on specific in-child (biological or psychological) characteristics. I would also argue that the state of the remedial situation will continue to be diffuse and confused until we haven gotten to what are some of the substantive questions which underlie the instructional system by child interaction.

An example of the state of the art is the current interest in the hyperkinetic syndrome question. We are undertaking a series of studies relating to this question in our program at UCLA, and as a consequence have done a rather careful review of the literature. I am quite honestly appalled at what's there or, to put it the other way, I am appalled at what's not there. There are many, many descriptions of correlates; there are many descriptions of behaviors, and there are practically no studies which deal with what I view as the underlying question, i.e. why do hyperactive children have learning problems? We all know that there are many children who have high energy levels and high activity levels who are very good learners. Why do some hyperactive children have learning problems?

JOHNSON: And if they haven't read that article on your review, I recommend it. For the past several months we have been looking at children who had been labeled hyperactive and are beginning to see many of the things Barbara discussed in her article. One of the most important characteristics seems to be the differential rate in decision-making among these youngsters. Also, we found an interaction effect with the environment. Often the children become more hyperactive when they are anxious or when the material becomes too difficult for them to assimilate.

HARING: May I respond? Well, my response was initially appropriate but I want to hear your response to Doris's and then I will.

KEOGH: What we are trying to get at is: What are the processes in the child's performance which interact with the task to produce learning success or failure? Relative to normal achieving children, do hyperactive children have faster reaction times? Do they have faster motor times? Is it that their decision-making is too speedy or impulsive? Based on behavioral dimensions, we are willing to accept that we can identify children whom teachers view as hyperactive and whom parents view as hyperactive. Some of these children have learning problems. Now why do they? That is the kind of question that may lead us to some remedial implications.

HARING: Barbara, we have quite a number of studies on kids using n-of-1 that show that if you can modify the behavior in the sense that you can get them in the seat rather than out of the seat, you increase their rate of academic performance. That doesn't answer your question about the complexities. Are they more rapid to respond, do they make poorer decisions or better decisions, but just modify them so that they're in seat rather than out of seat, and you'll increase academic performance.

KEOGH: Well, it seems to be that there may be differences. If a youngster is hyperactive, if his problem is that he can't get in his seat and sit still, he's obviously not able to attend to whatever are the inputs in the situation.

HARING: We've dealt with in-seat behavior as though it were voluntary.

KASS: But you are using the label hyperactive. I mean, you are accepting a word.

KEOGH: We use the word, I suppose, because it does identify for us children who have some similar patterns of behavior who sometimes also have learning problems. Our concerns have been with why should they have those learning problems when they've obviously learned a lot of other things well. What is it about that child's performance that is specific to the task or the situation? In light of my argument for an LD model based on continuous dimensions, we have used as a model for some of the work a series of studies of aging. Older people are perceived as moving slowly. Yet, some evidence suggests that it isn't just that old people move more slowly but that they take longer to make the decision to move. That's the kind of thing we're trying to pinpoint with young, hyperactive children.

HARING: I know this begs the question, but hyperactivity can also be defined as a high rate of responses to academic performance. But a teacher would rarely identify a child on that basis. He has to be out of seat before he gets . . .

MC CARTHY: One of the most interesting elements that came out of the New York Academy of Science conference on Minimal Brain Dysfunction that Dr. Strother mentioned yesterday was a paper presented by Dr. Solomons from the State University of Iowa medical school in which he referred to a study that Werry and (I think) Quay did in The Urbana Public Schools in which 53% of the boys in the primary grades in a school in Urbana were diagnosed by their teachers or described by their teachers as being hyperactive. For three days, at this conference on minimal brain dysfunction, speaker after speaker equated hyperactivity or hyperkinesis with brain damage and extolled the merits of treatment by one of the dextroid amphetamines. Solomons then asked all of his colleagues to address themselves to the question" "Are we literally saying, and do we mean it, that 53%, over half of our young males, are brain damaged? Because if that, indeed, is what we're saying, then as a nation we're in trouble." If we are talking about putting half of our young males on medication, we need to be aware of the critical nature of this line of thinking and of this question.

KEOGH: In support of that, I would make the argument that there are a number of very high achievers who have very high activity rates.

MC CARTHY: I think that's why the question is so critical.

KEOGH: Therefore, what are the things that are different and where in the process of that interaction do they break down for that child who is "hyperactive" with learning problems?

STROTHER: As I read the literature on hyperactivity, it seems to me that there is now considerable agreement that it's not the quantity of activity but the appropriateness of the activity. This is consistent with Norrie's comments too that we define appropriateness in terms of the social situation in which the activity occurs.

KEOGH: We have tried to get at that question. As example of the kind of confusion that exists, someone used the analogy that hyperactivity is like pornography -- "I can't define it, but I know it when I see it." We have chosen to go the process route in the sense of looking at where in the learning situation or in the process of learning the hyperactive child with learning problems different. Is it reaction time, is it response time, is it motoric time, is it decision time? Or is it primarily situationally specific?

SENF: Could I interject here a comment about categorization? You have to be pretty darn sure when you undertake a process study as fine-grained as you describe that you have correctly recognized the pornography. You certainly don't want to have an unselected group of L.D. children. You see the implicit contradiction. You don't want to categorize but implicitly you know that if you don't your study's not going to work, being overwhelmed by between-subject variability. So that at one time you try to say we don't need categories or that such do not exist while at the same time carefully select homogeneous samples for research. I agree with the caution exercised in sampling but further believe that we must not abandon categorization.

JOHNSON: And defining hyperactivity is already interpretative.

KEOGH: You are quite right. As you review the research literature relating to hyperactivity, it is clear that some studies involved children with neurological signs; they are defined in those terms. Other studies involved children having difficulty in school programs, children whose symptoms were primarily behavioral. Some studies lumped everybody together. You really have to sort this out. This supports my original point that until we begin to get at what are some of the basic parameters, our definitions are bound to be fuzzy and confused and the sampling mixed up.

That's why I was delighted when we were able to apply the Welford model on aging to an analysis of the behavior of hyperactive young children; we were dealing with the same variables, and we found it worked. As with older subjects, it tells us something about how those subjects approach and attempt to solve a task. We were encouraged by this. I would argue unequivocally for the assumption of continuity of experiments across age and across categories.

There's one more example in terms of hyperactivity. If the child's problems are in terms of his inability to get in his seat and to pay attention at that critical input stage of problem solving, that suggests a particular kind of remedial program for a teacher. The teacher could then focus on that aspect of that child's behavior. If another child, also called hyperactive with learning problems, is able to attend initially, but is unable to sustain that attention to finish something, then that seems to imply a different kind of remedial emphasis. If a child is hyperactive and makes impulsive decisions, then still another kind of remedial emphasis might be considered. All these strategies might be used by the same teacher within the same classroom, but would involve some individual differences in emphases. For one child you want to be sure he gets the information in the system, because if he gets it in he's all right. For another child, the strategy is to slow him down, to get him to think of other answers or solutions. For still another child you want to improve his ability to sustain performance. To say that we can handle all hyperactive children as a single category, I find impossible. Therefore, although we use the same label, we must look for processing variables which explain individual differences in performance. These individual differences provide the basis for remedial planning.

STROTHER: I'd like to raise a question. I'd like to hear you and Norris interact, because I think this is a good illustration if I'm correct about this of the differences between the cognitive and the operant approach. What you're talking about here is a process analysis and what you are meaning by process is all of the inner functions that occur from the point of stimulation to the point of output, like attention and decision time and so on. Now what's the difference between that kind of an approach and the therapy that would follow from it and the approach in which you make the analysis essentially in terms of the task? You start with the task and say what's the hierarchy of behaviors that enter into this task. What's the difference between a process hierarchy and a task hierarchy?

HARING: I will respond because I think it will give you time to think of a better answer, Barbara. I suspect that we're looking at the same responses in the sense that the response is a summation of any activity, whether it be considered as process activity or, as we consider it, a response to an antecedent as defined by an immediate cue. We're probably talking about the same behavior, so that the differences would lie in the inferences Barbara makes about what underlies the behavior. Simply, I would make no inferences about what underlies the behavior.

STROTHER: The question though is what are the implications of such inferences for the way in which you deal with the child? Are there different implications or aren't there? If there are no different implications, then we just look at these as two different alternative ways of conceptualizing the problem.

HARING: Well, at the present time, in response, I think we have to look at it as two different ways of conceptualizing. But possibly someday, with close interaction with inferential basis for responding, we could get closer to that.

SENF: But there also may be different implications besides treatment implications of the two models. They might have no different treatment implications, which probably isn't the case, but even if they had the same treatment implications, the implications for further research questions might distinguish the two models. So they're not completely interchangeable in that sense. You look at different variables when you come to ask the next question. The behavioral model leads you to different things than the cognitive model would.

JOHNSON: We were on that same question at a meeting last weekend with a neurologist who is moving educationally and behaviorally. The criteria for decision-making by the teacher seems to be a major issue. Does the teacher using behavior modification have a list of questions, for example, when choosing a task. What would be the criteria for choosing the next task? When a process approach is used there's a certain amount of baseline data which form the criteria for choosing the next task.

STROTHER: If I can, I'd like to push this down to a very concrete level because the thing that bothers me is that we talk on such an abstract level that we can't get down to the operations that are necessarily involved in research. So I'd like to push this if I may down to a very concrete level. Let me raise this question. You talk about some hyperactive children as differing in their decision time. What are the situations, the observations from which you infer a difference in decision time? And once having inferred that, what do you do? And then I'd like to ask Norris given the same observations in the situation, what are the inferences you would draw and where would that take you therapeutically. And I think this will pin us down to specific observations and the consequences of them that will enable us to get beyond an abstract level in the discussion.

KEOGH: I reiterate that I take a strong interaction position. I think that most "in-people" characteristics vary in terms of the requirements of that the person is asked to do. There is considerable evidence to support that. Some tasks we all learn very easily, but when faced with difficult tasks, we may reach solutions in rather different ways. It is terms of task complexity that I would say that the interaction would differ. Let me refer specifically to performance of hyperactive children in terms of task requirements, following techniques derived from the Welford model of studies of aging. If you give a child a deck of cards and ask him to sort the cards into two piles, face down--he does that quickly and easily. If you ask him to sort them into red and black piles, it takes longer. Although he did the same mechanical operation, it took longer to make the red-black decision. The same thing holds for more complex sorting. If you sort into four piles face down, it takes a shorter time than it does to sort into suits. Nora Jacobs, a recent UCLA doctorate, used this card sorting task in a study of hyperactive children. She was concerned with defining motor time and decision time, the latter arrived at through a subtractive process. One could hypothesize, and we did naively at first, that what would happen as task complexity increased was that normal children would make appropriate changes in decision time in order to solve the task correctly, whereas hyperactive children would not modify their decision time. That was naive. What we found was that hyperactive children took longer to do a complex task than did normal achieving children. The reason for that, we think, is that hyperactive children make so many bad decisions that they spend a considerable amount of their time playing "catch-up." As example, they put the king of hearts in the diamond pile, then had to retrieve it, and by this time, they had started to do something else and had to retrieve that. They spent a good deal of time responding to bad decisions.

STROTHER: Or impulsiveness.

KEOGH: If we analyze school tasks in the same kind of terms, we might ask: is the child motorically overactive in the general sense (I suspect there may be some children like that) or is he carrying out and responding to poor decisions? My guess is that most hyperactive children with learning problems are in a rather continuous game of catch-up in the classroom. They respond quickly, they make mistakes, and then they have to expend extra energy and activity to retrieve that mistake; this interferes with the next stage of the task or learning. We have, thus, a very real confounding of decision errors with motoric impulsivity.

STROTHER: So your primary strategy in dealing with a child like that would be to set up a situation in which he would learn to delay his initial decision time.

KEOGH: That might be one.

STROTHER: It would seem to me to be the most straightforward implication. Now how would look at this, Norris?

KEOGH: And we'd probably use reinforcement techniques to do that.

STROTHER: There are two different questions: would you do the same thing, really would you present him the same kind of task, and then to what extent and in what way would you use reinforcement, if you would and so on?

HARING: I would approach it this way and I'm sure you have already approached it that way. It's strictly a rate question. I would set up a series of tasks requiring response, whether it be a matching task or a sorting task or a multiple choice task with a button press. It wouldn't make an awful lot of difference I wouldn't think, and I'd simply get the rate on one-minute samples probably because that's very efficient. And I would run a series of one minute samples on this child and see what his rate is. And we would need to break this up, by correct rate and error rate. If the rate is up, the rate is good, then I'd work with the error rate and try to get the kid to take better shots but I wouldn't want to reduce his rate.

STROTHER: Well, how would you work with error rate?

HARING: How would we work with error rate? I would probably look at the task and start with sequencing the task.

STROTHER: Let's take this very simple situation where the child is sorting cards into four piles and you find in observing the child that he makes a number of errors and the total amount of activity is greater then because has to correct those errors and so on. Now we're talking about a specific error rate. What would you do with the error rate?

HARING: Most operant people, drawing from the hip, would say we'd try to reinforce correct rates. But we've had a lot of luck with looking at the task and resequencing it. I'd do this first.

STROTHER: What do you mean by this?

HARING: Arrange it so that it is sequenced in a more appropriate order for correct response. Sometimes. . .

STROTHER: But how do you break down the card sorting task into sequences?

HARING: First of all, we'd look at the cards to which the child is continuously making error responses.

STROTHER: Suppose he's distributing them by suits and these are randomly distributed by suits. Then, what's your next step?

HARING: Well, I might rearrange the cards.

STROTHER: In a different order. Yes, I see.

KEOGH: Now here's a difference. I think our first response to that would be to make more salient the discriminating cues on the cards; i.e., we would get the child to attend to what were the discriminating cues, in order that he might make a better decision.

STROTHER: Yes, this would be the same thing.

KEOGH: We also might go back to a simpler task, i.e. to a two card sort.

STROTHER: Well, if that's the case, then I see no difference in the implications but only a difference in the language.

KASS: But then what about the transfer?

KEOGH: But I think Jerry's point is well taken. That it might lead to some very real differences in the nature of the research question.

STROTHER: Ultimately, yes. That's a legitimate point.

HARING: We were doing rate of subtraction with two youngsters. And one youngster we continued on and just concentrated on correct subtraction responses. We had three kinds of problems. The other youngster continuously made errors in carrying, so that we didn't reinforce this other youngster for correct responses, we went back and taught him to carry. And we brought his rate of correct right up quickly through that tactic.

CHALFANT: I'd like to comment in response to your question, what's the difference between task analysis and process analysis. I try to take a broad look at a task. A task such as handwriting, lends itself to a product analysis. What criteria does a teacher have for good handwriting? On product analysis, you can look at what the child produces. The next type of analysis is "procedural analysis." Does the child pick up the pencil with this hand, put it across his knuckle, tuck his thumb in, and write like this? That is a procedural analysis. A third analysis is the "situational analysis." Under what conditions does the good handwriting occur and when does bad handwriting occur? And finally there is the "process analysis." What psychological processes might be involved which contribute to poor handwriting.

In terms of a task analysis on a handwriting case, we did a product analysis, procedural analysis, a situational analysis, and a process analysis. If we hadn't done the process analysis, we wouldn't have learned that the child didn't have feeling in his fingers. He had a finger agnosia. He couldn't tell you if you were touching his fingers, you could almost stick pins in them. He was very poor in manipulating his hands. If we hadn't done a process analysis, we wouldn't even have come close to that problem and would have continued to reinforce correct responses, rearrange the paper, and manipulate the materials in his environment without purpose or direction. There may be occasions that a process analysis might be helpful. I think that if Norrie had worked with this child he would have worked with the involved hand. The question is efficiency. When is it necessary to go into a process analysis and when is it not? In this case, about three or four months are wasted because the problem was not identified. I think that regardless of the decision-making system, professionals often may eventually do the same kinds of treatment. We need to develop efficiency and effectiveness in decision making.

KEOGH: I think that if you adopt the interactional stance, you get out of the bind you're proposing. I don't see this as a dichotomy. We're talking about the kinds of processes the child bring to the task; I think it's got to be put in that frame of reference. We might come to the same kinds of procedures, and we might get there from different points of view, but I think Jerry's right that our next questions would be very different.

SENF: You both kind of came up with the similar idea that the child's not attending to the appropriate cues, i.e. he sorts prior to attending to the cues. It's also possible the child looks at the card and says, "Oh that goes in this pile," throws it the wrong way, and then has to retrieve it. That is to say, it could be a process different from attention. Where did you get the idea of attention in both cases. Was it intuitive or was it derived from your model.

HARING: Just experience.

SENF: Maybe why you come to the same answer is that you retreat at the interpretive point to intuition and you don't force the discrepant models to continue making your predictions for you. It may be that the models are really different and would force different predictions if you make them strong enough to make those different predictions, i.e. you restrict your model so that it has to predict one thing or another. Then you could evaluate the prediction.

KEOGH: You're right, that's what we would like to do. One thing nice about talking about hypersensitivity is that nobody knows very much anyway so we can all stumble around together. We're at that point. We have chosen to conceptualize hypersensitivity in terms of three possible models and now we're trying to test those empirically. I have in my own mind given up our first hypothesis or model because I don't think it's very fruitful. The second one, which has to do with analysis in terms of reaction time, decision time, response time, I think is possibly a productive way to go.

SENF: Those are in a sense two minimodels, if you will, which predict different behavior in different (experimental) situations.

KEOGH: Well, as I say our first guess was that we were dealing with a too fast decision time and therefore as task complexity increase there ought to be an increasing discrepancy between the normally achieving child and the hyperactive child with learning problems. There was. But our first guess was naive, we guessed the wrong way because we did not correct for the error possibilities in the response.

KASS: Well, tying back to what I said before about the case for theoretical framework, I think it would be interesting if we could treat some of these approaches as games and try to play the other person's game. This might be fun for some of us to do, because I think there is an argument for dealing with the child from various stances.

STROTHER: Let me just interject, Norrie, before you make your comment. This is exactly what it seems to me has happened in learning theory. I.e., you specify a particular kind of situation--this card sorting one might be a good one, the simpler it is the better--and say, now this is my analysis of it, these are the inferences I draw, and these are the implications, the predictions I would make about alteration. Now if we could do that more frequently having very standard kinds of situations and being very explicit about our inferences and assumptions and basing our intervention on those inferences and assumptions as best we can, then we've got a way of empirically testing these alternatives. And that's what's been lacking in this field. We've all picked a wide range--well, I've said enough. Norrie, you were going to make a comment.

HARING: On a two-choice, just by chance you get 50% right. And if you increase the number of choices, the number of options, you reduce the accuracy.

KEOGH: But we also know that you up the incidence of behavioral evidence impulsivity when you increase the ambiguity of the situation task. One could make the argument that the youngster who has a lot of uncertainty is in a relatively continuous kind of ambiguous world and, therefore, you're upping the rate as a function of that.

SENF: Now do you want to let the words "impulsivity" and "uncertainty" enter into the theoretical structure? Because if you don't, that's trouble again.

KEOGH: As I say, that's one of the things that we are pursuing, the question of whether the increase in task complexity is in fact an increase in ambiguity. I don't want to get into that.

SENF: This is just a general issue which I'm sure we see eye to eye on. You don't want to let in those terms which we all talk about colloquially as though we all know what they're about unless they have some specified relationship to the other terms in that miniature model that you're using or else you always let yourself off the hook.

STROTHER: Well, I don't see why that gives you any trouble because it seems to me the term "impulsivity" can easily be translated into decision time and into rate.

SENF: Yes, that's what you want to do. You want to keep all terms strictly defined with respect to the others so that you don't begin to drift off into a broader colloquial analysis of the situation. The incisiveness and falsifiability of your model will be lost.

BRYANT: If we start using terms, and I think this is crucial that we do keep pinning it down by operational definition, the first thing that comes to mind is Kagan's work. He defines impulsivity not only in terms of decision time but also in terms of errors which gets into a totally different ballgame. And I've got a couple of dissertations which find that impulsivity is not related to academic achievement, by the way.

JOHNSON: Impulsivity may play a role in some cases, however. We have begun to look more closely at the ways in which children manipulate objects and materials, thinking that their behavior may affect learning. Some of the Russians have filmed the hands of children who were given objects to manipulate and they round a rather strong difference between the manipulations of the three and five year old. The young children use catching movements whereas the older children tend to "model" the figure. We have begun some research with LD youngsters along these lines and feel that we may see differences between the normal and handicapped. Some of our youngsters merely let the object sit in their hands; others were quite impulsive in the handling but did not actually feel all around the figure. It seems to us that unless the child is attending and feeling the whole object that the information will not be "coded". Certainly we need to consider attention and active exploration both in diagnosis and remediation.

KEOGH: I think hyperactivity is probably a good example for us to talk about in that there are a number of tenable hypotheses which can be derived from different theoretical positions. These hypotheses do have some rather specific remedial implications; what I am saying is that to take such a term as hyperactivity, and to say this is an in-child, organically-determined, motor characteristic really doesn't tell us what we need to know. My argument would be let's raise a number of hypotheses from various theoretical positions and then we begin to sort out by empirical test which positions provide us with the most powerful information.

STROTHER: Well, you know it would be a very interesting outcome of this conference if we could agree that hyperactivity was a good test case to which we could apply these different analyses. And if we could do that and then really encourage our students to move into this area systematically, in another year or two we could begin to build up a body of knowledge that would take us a long ways ahead. Maybe that's one of the critical things we need right now.

JOHNSON: With strategies that would be transferable to the next area of learning.

KEOGH: It seems to me that we're at a point in time that as a profession we need a strong independent organization which is not tied to funding sources.

STROTHER: Well, let's leave this discussion. It seems to me this is one of the things we have to get at before we get through.

JOHNSON: And it's not happening out of CEC and it's not going to happen out of ACLD.

CHALFANT: What we need is a professional group.

JOHNSON: Barbara's been on the Ethics and Standards Committee. There's a question there as to if we can even write a professional code as one subgroup out of CEC without the whole group.

SENF: Every couple or three years.

KEOGH: The scientific organizations in the social sciences which have moved furthest are those which have strong independent professional voice. Their positions may not be accepted but at least they are clear. I feel the need of such a group in the field of learning disabilities.

INPUT LECTURE BY GERALD M. SENF

Well, I guess I'm sort of pleased that I found out this morning that even as a research psychologist I wasn't some sort of weirdo within the context of this group and that I could understand and substantially agree with much of what was said. That's sort of nice; I think I owe the comforting feeling to Barbara.

Also, Doris was certainly nodding in agreement quite a bit too. And the way you, Charles, picked up on the differences in approaches, zeroing in on more precise methodology for pinpointing specific process descriptions of learning disabled children, made me think that the kind of approach I have been taking in my research is not totally different and certainly not unknown.

I would like to devote my remarks solely to the issues surrounding research in learning disabilities. I am not heavily involved in application, though I do run a sizeable tutoring program at the University of Illinois, Chicago in which we train undergraduates to be companion-tutors for learning disabled and disadvantaged students, and as a Board Member and consultant to Beacon Therapeutic School in Chicago, do concern myself with the practical side of the field. Having taught exclusively in Psychology Departments, I an unfamilar with the specific training problems encountered in special education; I would imagine that many of the issues are similar to those which arise in the training of clinical and experimental psychologists with which I am familiar. However, I would perfer to restrict my comments to the research problems in learning disabilities as these are basic to the field's progress.

Specifically, I think I have heard some feelings different from mine as to how research should progress if we are to amass the kind of basic data and theory capable of generating truly affective remedial programs. I think it is a serious mistake, for example, to abandon categorization, whether due to frustration, misplaced equalitarianism, "political" pressure, fadishness, or whatever. Categorization is basic to a sample-difference research methodology which seeks a process description of the deficits underlying the learning problems of homogeneous sub-samples of learning disabled children.

One's methodology is part of the conception of the problem just as one's theoretical model and, hence, will lead one to ask questions in a certain way. For example, Barbara, in your research, do you use a control group, some sort of normal group used to establish expected "typical" behavior in the card-sorting tasks you described?

KEOGH: In the particular set of things I referred to, yes, we have used some kind of control group.

SENF: And you have a feel for what's appropriate behavior in the situation?

KEOGH: We had pretested the techniques with so-called normal-achieving children of various ages in a relatively random way and then, in the first of the studies that I referred to, we did use a comparison group. In a sense, I think it's not accurate to call it a control group in the experimental paradigm. It was a contrast group.

SENF: It gave you some basic norms from which you could say, look at this sample, it's different. And my guess would be that you don't always do that.

HARING: Yes.

SENF: You always do that?

HARING: We always seek out what is desired rate, what is normal rate, what does the normal child do.

SENF: Well, you're two steps ahead of most of my behavior therapy colleagues who go ahead without a charting on "typical" behavior, concentrating instead of applying whatever schedules and reinforcements are empirically necessary to modify the target behavior. It is an approach typically with different methods and goals than that of process research. Well, you didn't give me the answer I wanted but I'll continue without it. Never count on stereotypes.

My research has been concerned with isolating processes which mediate learning disabilities. The framework I have utilized is cognitive psychology, more specifically information-processing psychology. Quite independently, special education has adopted a terminology consistent with this orientation in favor of the medically-oriented terminology which did not prove to be educationally meaningful. Terms like visual discrimination, short term memory, and sound blending are less educational terms than they are constructs defined in relation to individual functioning. The implications of this choice of terminology are important for special education. Most basically, the adoption of a set of terms already understoon through previous psychological research is a powerful asset, obviating the need to do one's own background research and allowing one to get on to the critical issue of how one's special sample of children is unique with reference to the adopted framework. For example, it is not necessary to initiate lengthy programatic developmental research on visual discrimination as this has been done and continues to be done by others. Instead, as a researcher in special education, one can apply the research paradigms and specific testing procedures already developed to the learning disabled sample directly in order to understand these children of special interest.

I believe the potential strengths are not being utilized, however. There in fact is very little interaction between those working in basic psychological research and those in special education; I do not simply mean that the people don't get together but that they do not know each other's work. It is more important that the special education researcher know the basic psychological research within his domain of interest; I also would like to see more basic psychological, sociological, and linguistic researchers cognizant of the research issues in special education, perhaps accomplished by our initiative toward them, but the more important problem is making sure that the special education researcher knows the background literature relvant to the psychological functions he studies in learning disabled children. Knowing both literatures, I can attest to there being relatively little overlap.

I do not want to belabor this point but I do want to make the implications clear: it is impossible, foolish, and wasteful for special education to generate its own basic psychological research. The logical approach is to acquaint students with psychological research relevant to their areas of interest and research application. Frankly, much of the psychological process research in special education is second rate: it ignores what has been learned through years of research: it uses methods long outmoded by their lack of precision or inherent confounding: it fails to recognize the uniqueness of different conceptualizations of the same term because it is not conversant with the various theoretical models which seek to understand a given process or set of processes. Instead, a process, be it discrimination, memory, or whatever, is viewed essentially in layman's terms, each process being named and measured as though it were a real thing rather than an intellectural construction of the investigator. There is very little model building, specifying the relationship between the processes and, hence, no way to dispose of inferior conceptualizations which has resulted in a proliferation of terms.

I have discussed these problems in more detail in a theoretical paper written for the Leadership Training Institute's first annual report. The problems certainly do not apply to all special education research but it does characterize enough of it to question whether the research training of persons contributing to the learning disability literature on the average is adequate. And even if the formal training were adequate, the exposure to the supporting basic research is certainly not.

Research which seeks to understand deviant functioning poses many difficult problems which place additional demands on the investigator's research sophistication; it is very difficult research to do. When it isn't done well, that is, when the knowledge generated does not appear to be very useful or striking, there is a natural tendency to lose faith in research as a vehicle for discovery. Without going into the complex issues surrounding the role of relevance in research, I do think that at least some research and especially that within an applied field should be potentially useful, if only in the service of understanding. Basic research is too often the whipping boy for the wrong reasons. It is not well understood by many people nor do many people know where our present knowledge comes from. Those who cry for more service programs instead of research often give me the impression that they also think that present knowledge was God-given and is sufficient. At the same time, I know so-called basic researchers who turn out experiments like a Detroit production line, their products being equally ill-conceived. I do not think, though, that so much basic research, and here I include research which attempts to understand the unique problems of the learning disabled child, is bad through malice aforethought. As I indicated earlier, learning about deviance is very difficult; it is a huge intellectual challenge; it is a very expensive product which cannot be purchased as though it were a set of educational materials from a manufacturer or even as though it were a service program. Nevertheless, the research should show signs of paying off and at the very least should have a convincing rationale as to how it might pay off. The research picture in learning disabilities concerns me because I can see much of it neither paying off nor taking the self-conscious steps to make it pay off in the future. I am in essential agreement with Barbara that we have not made substantial progress in the last 10-15 years. But it is not research *per se* that is at fault but the inappropriateness or inadequacies of the specific research accomplished given the task at hand.

I see three very basic and central problems facing research in learning disabilities which characterize for me why substantial progress has not been made. Here I am not talking about evaluation research which seeks an assessment of intervention programs but rather that which seeks new knowledge. Evaluation too is a very tricky business which is accomplished as poorly in special education as in any other area. It is not that an appropriate technology is unavailable but that it is not applied. Certainly evaluation research also requires ingenuity. The failure appropriately to evaluate remedial programs, however, derives less from a lack of creativity than from a simple failure to use an evaluation design which logically can answer the evaluation question under consideration. I imagine that these failures derive principally from an unwillingness to devote the resources necessary to accomplish evaluation research and/or from unfamiliarity with evaluation research methodology. I hope to write a paper this coming year with the LTI which will describe appropriate, feasible designs for evaluation of special education programs.

Let me describe now the basic problems with process research in learning disabilities. The first problem concerns the heterogeneity issue. If one is trying to isolate processes which function irregularly, at least in the situational context of the classroom, it would be useful to be able to select a sample which would be homogeneous with respect to that process deficit. The only characteristic which learning disabled children appear to have in common is that they are not doing as well in school as someone thinks they should. Consequently, the population is likely very heterogeneous with respect to the underlying process deficits responsible for the school failure. When process research is considered in light of this line of reasoning, serious methodological and interpretive problems result. Take, for example, the hypothesis that the visual trace, i.e., iconic memory, of the learning disabled child is irregularly short causing him to make many more fixations per unit of information in order to understand printed text. If one were to select without restriction from a population of reliably diagnosed learning disabled children a sample to evaluate this hypothesis, my guess would be that the sample's performance on an iconic memory task would not be significantly different from that of an adequate-learning control group even though a few of the learning disabled children might have vastly inferior scores. For hypotheses which assess more complex functioning involving a number of subprocesses such as visual discrimination, sufficiently more of the learning disabled children may be deficient to make the difference between normal and LD samples statistically significant. The conclusion that learning disabled children do not have iconic memory problems but do have visual discrimination problems would be terribly insensitive to the reality observed but would be and is formally similar to the type of conclusions routinely drawn from one process research study after another, whether the research is otherwise well-conceived and carried out or not.

I think the crux of the problem is not being able to specify in more detail the subset of children to whom specific process hypotheses should apply. After all, the special education teacher wants to know whether a certain child has such-and-such a problem and not whether learning disabled children on the average have the problem. Faced with this predicament, the researcher ordinarily adopts one of four approaches. Some investigators persist with the same approach despite its illogic seeking those .05 level or "better" differences, probably because they do not know what else to do. Others, more ingenious, maintain the same sample-difference approach but carefully select those children for the learning disabled sample who will likely fit the hypothesis under test. I support the notion that the sample difference position should be improved rather than abandoned but cannot accept the problems inherent in selecting restricted subsamples unless done very formally. I shall expand this point in a minute. The problems encountered with selected subsamples are very serious: first, the results of the study are not generalizable to any know population as the sample was non-randomly constructed by the investigator. Second, the sample cannot readily be duplicated so that replication is impossible and discrepant findings are unresolvable. The value of research breaks down at this point. These problems are not solved by administering standardized tests and describing the selected sample in terms of their scores unless the sample is strictly assembled in accord with the test scores.

The third and fourth approaches to the problems with group research involve an abandonment of the sample-difference research method. One of these procedures involves idiographic, case-study research, a step backward, away from the discovery of general principles. Typically, case study serves to stimulate hypothesis formation and is in Reichenbach's terms, a better context of discovery than validation. I think we have a good example in psychodynamic psychology of what happens to a system of thought which fails to demonstrate its validity outside of the case study context. I would hate to see our understanding of childhood disabilities be so jeopardized.

The fourth alternative to sample-difference research is represented by behavioral approaches. These represent a potentially more fruitful alternative, especially when the investigator is more interested in altering the behavior of a specific sample of children. Certainly, task analysis represents a potentially complementary set of knowledge to that produced by process research. I do not believe behavioral approaches replace or represent alternative paths to the same understanding as process research will yield so that the problems posed by group data are not solved through behavioral methods but are avoided in favor of working on a somewhat different task.

Classification is certainly a loaded issue, involving as it does so many ethical, practical, and pragmatic dimensions. When I speak in favor of classification, I am talking only about a research method for advancing knowledge, a categorization of disabled functioning, not of children. Whether one chooses to use a category system for individual diagnosis involves additional considerations. What I wish to distinguish is categorization in the service of process research from present diagnostic practices. The biggest problem with present educational diagnosis is its lack of established validity for remedial programs. Diagnosis is frequently too coarse, as for example labelling of a child learning disabled after the teacher sent him for lengthy tests because he was behind the rest of the class. Typically, one wants a diagnostic system to imply specific treatment plans as a correlate of each diagnosis (although we should recognize that category systems could be valid with respect to other variables and not to treatment plan). Alternatively, other diagnoses are very specific and individualized. If one seriously believes that each child's problems are unique, one admits to having to construct each remedial program without reference to precedent. However, I do not believe that such an insistence on individuality is an accurate reflection of the reality nor is it a service to the child. I would rather believe that we do not understand and, hence, cannot recognize the regularities that occur. Even so, teachers with experience recognize similarities as differences in the problems faced by their pupils and are aided by their previous experience because there is repetition of problems.

The task as I see it is not one of finding different types of children but to group similar problems together so that they can be studied further. I view all children as operating under the same general principles, some having to make adjustments due to extreme variation (disability) in some function(s). The disability can have widespread implications for the child's total adjustment creating the appearance that he has a multitude of problems. An adequate theory of how underlying processes are interrelated may show that even the child with multiple deficits may have a single basic disability from which the remaining problems derive. What I am stressing here is that categories need not represent different types of children but can just as well be areas of deficit shared by those so labeled. Even the deficits of those within the same category may be different in detail but will still be more conceptually similar to the problems of others in the category than to those represented by a different category.

What I wish to contend is that our categorization has been applied at a level inappropriate to be useful. Were we to have categories of deficit whose correlates would describe the process problems and "recommend" validated treatment approaches, I doubt that we would see the present anti-diagnosis sentiment. The problem is finding meaningful categories such that once the diagnostic label has been arrived at, an understanding of the child's problems and appropriate treatment procedures will follow. Such a system would immeasureably aid communication such that studies accomplished on children of a certain disability type could be replicated by other investigators. Further, research would specify the children under study at a level of specificity that the practitioner could genuinely utilize the results of research. Such a common ground may be what is needed to stimulate interaction between practitioner and researcher.

I have been working on a solution to the categorization problem for some time and believe that an empirically-based approach is desireable. Professor Andrew Comrey of UCLA is working with me on this lengthy project, he providing the expertise in psychometrics as I provide the content knowledge. We hope that with proper funding, we can have the initial system constructed and initial validation undertaken within 2-3 years.

So the first basic issue in learning disability research is the one of heterogeneity. The second major problem is that many of the behavioral assessments used in research do not have established meaning. This problem derives I think from an unfamiliarity with either existing research or the philosophy of knowledge or both. Though pretentious sounding, I mean only that the investigator must more than assert that a given index measures a certain process or condition. Face validity is a tenuous and insufficient criterion for meaning and is the sole one too often utilized. A specific example will clarify what I mean. I select an example from the work on intersensory integration because I have recently contributed to that area. I believe Professor Birch, who is most closely associated with this line of research, made a basic error in calling the sensory matching tasks measures of intersensory integration. In the research I am referring to, the subject is required to select from a set of three alternative patterns of spatially distributed dots the one equivalent to a temporally distributed pattern of pencil taps. Failure to make the correct choice was thought to indicate poor intersensory integration.

The central problem here is that lacking a theory of intersensory integration and alternative measures of the construct, the construct and the operations are identical except that the construct has surplus meaning. Could not the same test measure memory? Or visual encoding? Or auditory encoding? Or rhythm perception? One need recognize that a single behavioral index is an inadequate basis for inferring a hypothetical construct. If one has a single measure, a more neutral position would be to name it descriptively, for example, "auditory-visual matching task."

I do not know if you see this as subtle distinction or a major one as I do. If one can generate a new construct for each test one derives, the number of constructs allowable is infinite. Further, because it is typically the case that learning disabled children perform more poorly on nearly any test than does an adequately achieving control group, it becomes almost meaningless to show inferior performance unless one can quite conclusively show what it means to be deficient on that test. There are a number of ways that you are all familiar with to establish meaning (validity). Let me conclude this point by telling you the results of our investigations into intersensory integration. On his masters and doctoral research, the latter work assisted by Professor Arthur Benton, Lewis Vande Voort found that the performance decrements of learning disabled children on matching tasks were not limited to those containing input from two modalities but were also evidenced when matching was required to input arriving within a single modality. Intersensory integration would appear to be an inappropriate "name" for the deficit observed. The misunderstanding could have been avoided had more stringent standards of meaning been adhered to. Paradoxically, I agree with Birch that integration is an extremely important process and have made it the central process construct of a recent theoretical paper written for the LTI (An Information-Integration Theory and Its Application to Normal Reading Acquisition and Reading Disability). The matching task, I believe, fails to assess the process adequately.

To sum up this second research problem, my major point is that each time a new testing procedure is evolved, its meaning must be established through its relationships with other measures and variations in the testing content or context. Constructing a test to assess a construct is frought with problems: the investigator would do better to find some assessment device whose meaning is better established and through judicious variations in that established paradigm come to understand the child's functioning through his performance. Many reading diagnostic batteries are prime examples of tests which have only face validity and commit the mistake of naming a scale as though the name were what and only what were being measured. I believe that in many cases, these errors result from a lack of understanding of behavioral science philosophy and methodology.

Let me now discuss the third major problem I see with much of the research in learning disabilities. Stated most succinctly, there are not enough potentially falsifiable assertions around which research can be conducted. Typically, theoretical models provide deductions which can be contrasted with the deductions derived from other conceptualizations. Irrespective of whether the adversary models apply to broad spectra of behavior or are limited to predicting behavior in a restricted sorting task like those Barbara described, their essence is that they are specifically enough stated that empircally testable deductions can be evaluated. As I pointed out earlier, the adoption of information processing terminology by the field of special education was not accompanied by a similar adoption of the spirit of model testing. Instead, the most general information processing framework seems to have been selected, a framework which by default considers an indeterminate number of subprocesses to be related in a simple additive fashion. A given child can presumably have any number and any combination of deficits; no given deficit is predictive of any other nor is one deficit thought to be more basic than any other as nowhere are the relationships between the subprocesses specified in a falsifiable fashion.

It is perfectly understandable why one would wish to avoid the detail and seemingly nit-picking distinctions characteristic of basic psychological research. I can also understand where the information processing models derived by experimental psychologists may appear inappropriate for learning disability research in that they highlight subtle theoretical issues within information processing. As I say, I can understand these reactions but I'm not sure they are valid. Without arguing the point of whether certain specific models are or are not appropriate, I would rather assert that the rejection of those available requires that one produce an alternative one or else one has nothing to test. This point holds true not simply for information processing approaches. How many articles will we publish showing that learning disabled children are more anxious than their normal counterparts in school situations? Lacking a theory of anxiety (and usually adequate measures) most such studies are worse than no research at all; they assert little more than the obvious while failing to falsify alternative positions. Worse than no research at all they deceive us into thinking that knowledge is accumulating.

I have only been able to speak in generalities here and so have given overall opinions. There is some very adequate research in learning disabilities but in my opinion it is rare. I wonder how many persons there are within special education who truly view themselves as primarily research oriented. Can they be expected to train to an acceptable competence level and supervise the research of the many graduate students? Clinical psychology's research is bolstered by its being housed with and jointly supervised by experimental psychologists. I wonder whether special education as essentially an applied area has the unique problem of adopting a psychological orientation without having also the backup support that a strictly experimental subdivision can provide? The problem is compounded when much of the basic research support derives from another discipline. Though clinical and experimental psychology are not happily wedded in most psychology departments, there is no doubt that their union has had an effect on the research into clinical problems. Though interaction between research psychology and special education might result in similar friction, the isolation presently practiced may be particularly costly to advancing knowledge about learning disabilities. The important problem for the field presently is bolstering its research productivity in those areas which will provide a genuine understanding of the child's school performance and lead to a remedial technology which can be continually reevaluated and updated. The most basic problem which must be solved remains the definitional one, how to characterize the children under study. This problem will not be solved in discussion but requires empirical designation. With a more manageable population of study provided by a reliable, empirically based classification system, investigators can undertake the task of studying the characteristics of these more homogeneous subgroups, preferably with the aid of miniature models or theories of behavior which provide testable deductions about educationally meaningful dimensions.

STROTHER: Well, let me start with a question. You've made two very important points about research strategy, this question of heterogeneity and the question of definition of function. And your argument on this question of definition of function I think using the illustration of cross-modality and intramodality differences was a very persuasive one. But, I am not yet equally clear about where your research strategy would go on the matter of homogeneity. And let me pose the question this way to be very explicit about it. You have said that this matter of visual iconic memory deficiency raises some significant questions, some significant hypotheses about stimulus trace duration and that in order to examine that one of the things you need to do is select a homogeneous population with respect to visual iconic memory deficiency. Now my question goes to efficiency of your search for such a population. Would you choose to search among all children who have learning difficulties or would you start in the beginning with a little more precise definition of a population where you would have a higher probability of identifying those. . .

SENF: That example I offered mainly because it's intriguing and yet such a low probability event, I think, that it kind of had both aspects. It is sort of like: oh, that's interesting; oh, there is no way, maybe a couple children out of 2,000. So I think that the strategy has got to be to break up not in terms of processes of that order but in terms of much broader categories.

STROTHER: Such as?

SENF: The first step seeks factors which underly the criterion behavior of interest. I am particularly interested in reading, both as a cognitive skill and as the prime disability of most learning disabled children. We are, therefore, seeking an exhaustive list of those dimensions which singly or in various patterns are critical for adequate reading. The second step in the program involves a search for profile-types among the charted factor scores of learning disability children. This task is logically the same as that employed by achiarially-oriented personality researchers working on the MMPI (Minnesota Multiphasic Personality Inventory). With the set of scales describing personality functioning which the MMPI represents, one finds that certain profiles of charted scores occur quite frequently. For example, one deviant, though repeating, profile pattern is the 4-9, high (deviant) on Psychopathic Deviancy (scale 4) and Mania (scale 9). This profile type can be defined empirically and occurs sufficiently often to allow more detailed research into the characteristics of persons who score in this fashion. More detailed knowledge begins to accumulate. Research is replicable because the sample selected is empirically defined, thereby vastly improving the reliability of subject selection.

To understand reading disabilities, one needs first to isolate more homogeneous subsamples (profile types). Factor analysis seems to be an appropriate method to isolate the underlying dimensions and cluster analysis and/or "clinical judgement" reasonable methods to derive the profile types. Research would be immeasurably stimulated and improved were we to have such an empirically-based category system.

Our plan involves studying 400 or so 4th grade boys behind grade level in reading together with an appropriate control sample and study the factor structure of a wide variety of test characteristics that discriminate the samples.

STROTHER: But getting away from this question of procedure, because I think. . .

SENF: The procedure is important because what you end up with is empirically-defined profiles of disabled functioning. . .

STROTHER: I think we all agree with that, but you were talking about garbage in and garbage out and now you're saying take 400. . .

SENF: Gargage is defined not in terms of the psychoeducational dimensions but in terms of the statistical characteristic of each of the input dimensions. You can't just take some scores that have verious ranges, some from 5 to 8, other scores which have a range of 1 to 10, other scores which are normalized with a 0 mean and a standard deviation of 1, and other ones that have some other distribution, some that are skewed positively and some negatively, and throw them into a factor analysis. What you need is a set of measures which define the factors underlying the differences between normal and retarded readers among other considerations.

STROTHER: But you don't know that yet.

SENF: What do you mean you don't know that. You have to discover that. That's the task, exactly.

STROTHER: But look, I think what you're saying is this, and I don't want to take too much time on that, I think what you're saying is this: if you set your criteria for the test you're going to put into your factor analysis simply in terms of statistical criteria, on reliability, let's say. . .

SENF: No, validity, being able to discriminate those that can and those that can't.

STROTHER: But you don't know what test will, you see. That's your problem. That is what you're going to discover by this strategy.

SENF: Oh, I'm sorry, I did not make it clear.

STROTHER: How do you start?

SENF: One does not use a testing device in the factor analytic work unless you have previously validated that it does discriminate between those that can and those that cannot produce a reasonable level of school performance. This external criterion is defined more sociologically--like a teacher or school psychologist saying, "this kid's behind;" parents saying, "my kid's behind." You take them all as your initial population of study. You don't say, I'm sorry, he's not a dyslexic. You don't say, I'm sorry, he's culturally deprived.

STROTHER: Let me ask just one more question and then I'm through. Suppose you take them all, this whole group. Now you've got to generate from them scores on certain tests. Well, what tests are you going to put in?

SENF:Ah, that's where you hope you have read the literature; and you use any test that the literature has shown discriminates between samples of learning disabled and normals, however defined. You try to make the test exhaustive of the underlying dimensions. I am describing a test construction program that takes years to do, it's looking for factors, it's revising factors, it's throwing out measures and adding others, until you can feel you are adequately assessing the domain.

KEOGH: Didn't Cronbach talk about it years ago when he talked about construct validity? In a sense he was getting at that; you just don't select randomly. You select on the basis of something derived from some kind of construct, so that if you don't have a construct you put the garbage in because you don't have anything else to put in.

SENF: You're right, you can't just take scores: you can't take a lot of scores, factor analyze them, and hope that you'll get something meaningful out of it. You have to be very assured that the kind of dimensions you are dealing with have something to do with the differential performance that defines the child you're interested in. I want to discriminate this specific approach to test construction from process research on smaller segments of the population that we call learning disabled. These two activities are separate though I clearly believe the test construction program is prerequisite to for more sensitive, meaningful process research.

STROTHER: Well, let's broaden the discussion. There're other questions, I suppose.

MC CARTHY: I am just wondering, in relation to what you just said, Doris, how this discussion would relate to the prevalence study done with third grade children by Myklebust and the others in your department at Northwestern. Did you approach the idea of using the data that you gathered in about the same way that Jerry is talking about? These were all third grade children, were they not?

JOHNSON: Right. I was not very involved with that study, except in the initial planning stages. However I do agree that there is a need for looking at subgroups within our total population. All too often, differences are overlooked in mass studies. For example, on our studies of intra and intersensory learning this past year, we found quite different patterns of performance. Some children had high auditory and high visual abilities, but low intersensory ability. Others had high visual, low auditory, and high intersensory scores. It seems these intraorganismic differences are very important to study.

SENF: But in a sense, we like to believe that everybody is an individual. And yet, I know that when I go to a physician with a certain ailment, I don't like to be an individual. I like to be one of a large class of people who have this ailment and for it to be an ailment routine in the doctor's experience. It is really a two-edged sword to be an individual. And I would much rather view the area as containing categories rather than units of one child each.

JOHNSON: But there are many sub-categories within each single category. For example, as one looks at something like intrasensory perception one must consider variables such as the nature of the stimulus, attention, and memory factors.

STROTHER: I don't like to terminate this discussion, but time is passing. Corrine you had a question. Let's take that one.

KASS: I'm having trouble drawing connections between etiology and correlates and clusters and factors. I know you mentioned etiological factors last night and you mentioned many reasons here a bit ago on why some behavior might occur. I just wonder if we aren't avoiding another definition which we might make of etiology. I'm reminded of Charles Fries' work, of the taking of all of the tape recordings of the English language and coming up with a small finite number of sentence patterns. I wonder why it isn't just as reasonable to talk about some of the factors and clusters or subfactors as reasons why behaviors occur.

SENF: I see process research as distinct from etiological research almost more in terms of one's operating philosophy. You know how Lewin was very down on Freud for pushing the casual antecedents of behavior back to some point in time where no one could study them. Lewin was much more desirous of having a context whereby he could examine the immediate antecedents. To illustrate using a non-psychological example, take the case of a plan crashing. Why does the plane crash now? You can say, "Well, a few years ago when it was built, we had this hired hand who was a little incompetent." But you can also say that the plane crashed because the rivets in the wing gave out. You can also describe that same plane crash in terms of the structural failure of the actual alloy of the wing's rivets. Or perhaps the ground controller gave the plane very poor directions and the plane crashed, i.e., something external to the structure of the plane was an immediate cause. One can readily talk about the immediate causes of failure.

In the same sense, when you say a child has poor sound blending, for example you're saying that for whatever reason he's got poor sound blending, somehow this is critical to the fact that he is failing in school. You don't claim a neurological deficit, which may, indeed, be the historical antecedent (etiology) for some poor sound blending. You don't claim poor instruction, or any other historical antecedent unless, of course, you are interested specifically in such questions.

Instead you say simply poor sound blending. This is essentially saying at the present time when the child fails or when the plane crashes, we have isolated the ongoing process deficiency. Historically, I think the only difference between etiology and process is that the former is more distant in time and also that there is no other previous antecedent that we need look for.

KASS: Or more underlying at the same moment.

MC CARTHY: In struggling with this same sort of thing, Corrine, I've had to sort etiology and etiological factors into several orders of factors, because I think we have an immediate or proximate cause and then we have an historical, antecedent factor. If we really sorted out the etiological causes that we're talking about and all talked about the same level, we might have a level 1 etiology, we might have a level 2, level 3, and level 4. This is part of what I wanted to say in my formal presentation. We have been so religious, so assiduous, in our efforts not to look at etiology that I think we are denying the possibility that we are really looking at second order factors.

SENF: It's continuous. It's a continuous dimension back in time. The dimension between immediate causes and etiology is continuous.

KASS: I'm sure you're going to reach an end.

INPUT LECTURE BY NORRIS HARING

I was somewhat relieved to hear Jerry Senf's presentation because it causes me again to have some great source of satisfaction in that I believe that T. Ernest Newland is going to be replaced. Jerry's approach to some of the problems are. . .

The Experimental Education Unit--and I'll start with that as a background, I won't take you back historically any further than that--we've almost tongue in cheek begun working with the procedure that Dr. Strother described last night that's called behavior modification, except that isn't adequate either because the history of behavior modification is very restricted. The concentration on reinforcement, the application of reinforcement would fall short of explaining the kind of thing that we've been doing, as our research has stemmed largely from working only with observable behaviors, observable responses. At no time have any of us ever said this is the only way to study children. It isn't. It's probably the most recent way to study behavior and the use of observable behavior is, in this particular instance, the primary emphasis about making statements about children--the way they develop, the way they learn, the way they interact socially, and so forth. Then our almost religious fixation on observable behaviors has caused us in many instances to be seen as being very unilateral and we are aware of that, maybe even defensive about it. Yet that is the state of conditions, so what we've done is to develop a way of defining behaviors so that they are fairly available for measurement. That process is essentially one of pinpointing precisely the behavior that we're talking about. If it is an academic behavior, it would be a say sound or a say word or write letter, write number and so forth. The process of pinpointing then yields another very kind of definable response in the response that we call movement cycle. The movement cycle would be complete when it can be repeated, the movement cycle is something that must be observable, and it must be voluntary. So that those are sort of the three main criteria for movement cycle. The next concern that we have is an accurate record of this and on any movement cycle we believe that there is a definable correct response and an incorrect response, so that we will record correct and error responses. The next in this whole procedure of measurement, and now I am talking primarily about the dependent variable, is to provide an accurate and proportional display of the performance. Here around this issue is quite a good deal of controversy in that we have taken to develop further what Al Koeing and Og Lindsley developed at Kansas in 6 cycle semilog paper. We continue to utilize that. Our development of this has been to basically throw away 2 cycles of the 6 cycle paper, because most of the behaviors that we're interested in in the classroom fall within 3 cycles, i.e., once a minute up to 1000 times a minute. Almost all behaviors fall within actually two cycles which runs to about 500 times per minute in the case of silent reading. But now and then we get an unusually gifted kid and he'll move up to 1000 words a minute and we need to be able to record that. I think that if I could skip that for a moment, unless there are questions about it, I won't go into the merit of the cycles, the use of various numbers of cycles, or. . .

SENF: I'm curious as to the ones you're omitting.

HARING: The cycles we would omit would be say something that occurs once a day or once every hour or even once every ten minutes because almost all of our academic movement cycles occur more rapidly than that. Another important feature, and I will go ahead and mention that, is the use of the logarithm or the multiplier or divider of a number rather than the addition or subtraction. And that is, when we want to talk about change (and that's the business we are in, changing behavior), it's important that we display change proportionately. When we use arithmetic chart paper and talk about change, arithmetic chart paper does not display change proportionately. It would show for an example the distance from 2 to 4 and the difference from 10 to 20, let us say, which is a multiply by 2 difference. Arithmetic chart paper shows that change dramatically different, whereas the actual change (multiply by two) in our particular case, and I will show you why, must be displayed proportionately. From this, I think that I should tell you that we have developed all the behaviors in terms of social behavior and we have been able to talk mostly about out of seat, poking, punching, hitting, swearing, these kinds of things. We identify them very specifically and again use the movement cycle criteria as a way of defining the behavior. Academic behaviors are just as simple if not easier to identify in this way, and in working with academic behaviors we're talking now about saying sounds, saying letters, saying syllables, saying words, saying numbers, writing letters, numbers, and words, moving objects, pointing to answers or objects, pressing response switches and so forth. And with just a careful analysis of movements you can almost specify and define all movements that a child would use in a classroom. Now this is simplistic, so simplistic that I'm embarrassed about it at times. If you have no issues with it, I'll go ahead. That means that I've been able to at least oversimplify the point so that I bored you or you see the meaning around it or behind it.

Another concept I would present is that whole concept of rate. This too is a controversial concept but basically rate, frequency, and percentage are the data that behaviorists are using. We've come to more or less solder together these schools of rate, frequency, and percentage so that we don't disagree so much any more. The Journal of Applied Behavior Analysis has even published one of Tom Lovit's articles which uses 6 cycle, semilog paper and rate. And the Journal of

Applied Behavior Analysis was started by Don Baer who's a very strong behaviorist. By the same token, Tom Lovit who's at the Experimental Education Unit, Dale Gentry, recently they've been using percentage. Do I need to explain to anyone the difference between the two--rate and percentage? If not, we'll go ahead.

Rate, and again I'm superstitious, but rate gives the teacher some kinds of advantages that percentage doesn't have, particularly in working with the academic movement cycles. First of all, it does give a very precise measure of all instructional conditions, the effect of instructional conditions, including the strength of a condition that is arranged to motivate performance. It also provides the way for us to chart even on the same paper, and we usually do, the rate of correct responses and the rate of error responses. This gives two kinds of information to the teachers that percentage doesn't give. One, it gives efficiency, it gives you some index of how fast a child can do a task, and it gives index about the quality of the task, if we define quality by defining the relationship between the correct response and the error response. Another source of information that rate gives you in charting errors is often a key to the way in which we can rearrange the instructional program. In an instructional program, say-this program, children often encounter frames that create a great number of errors. The response pattern of children on a typical program where we set up and analyze the errors can tell the program developer almost exactly where his trouble points are. And as teachers have responded to the sort of challenge that Dr. Kirk gave this morning, that challenge that teachers need to be able to provide some of their own methods and some of their own materials, the advantage of having a way of analyzing performance in this way helps teachers determine whether or not the method they're using, the conditions they're arranging to motivate the responses, or the instructional program they're using needs further refinement.

With these as considerations we have been monitoring each child's performance on all academic tasks, pinpointed social behaviors where we're looking for social change because we have an inappropriate social behavior, verbal behavior, and sometimes fine and gross motor behavior. We usually do not monitor all social, language, or motor behavior. So that these charts we were keeping very religiously and continued to do that mostly because of our religion and we were monitoring every hour, every minute every hour, every hour every day. And it's very costly to do that. It's true it gives graduate students and in some cases undergraduate students a lot of experience with charting but it's very boring and they resist it. They still register for the courses but they resist it. So we've been working with asking several kinds of simple questions. If you sample less than the whole hour, the whole 20 minutes, or the whole session, do you get about the same information? We have about ten studies where we've taken one-minute samples and three-minute samples and five-minute samples; and lo and behold, we find that we can get just about as much information by taking a five-minute sample once a day in the particular areas of performance that you're interested in, you get almost as much information from that sample as you'll get if you take the whole session, say it's a twenty-minute session. There are certain kinds of academic behaviors that deteriorate with length and by taking the whole session you may not get as accurate a picture of performance as if you do take a five-minute sample. Well, of course, our graduate students are happy to hear about that and I think next year we'll probably move to sampling rather than taking the whole behavioral parameter.

I guess your question would be at about this time, how does this relate with learning disabilities? And I think one of the things we can say at this point is that we started originally by thinking that we could in fact find procedures and methods and materials that were good for all kids, all kids with learning problems. The last two or three years we've become very disenchanted with the possibility of this happening. We've look at Distar, we've looked at Sullivan, we've looked at I think almost every commercial program that's available, monitoring behavior. Some programs create a highly erratic performance rate when we look at error and correct rates. Some programs by themselves would create what you might call a learning disability, we call it a learning deficit.

A learning deficit is discriminated from a learning disability in the sense that as soon as the programs are arranged in any kind of reasonable order, the child's correct response rate does climb up. And I've got an overhead that kind of shows the difference between a learning disability and a deficit. You know, learning disability--performance there and changing that performance we find is a great deal more stubborn, if you will, or resistant to change than a deficit and it requires another screening, using Dr. Strother's idea. You say three levels of screening. But we can quickly identify learning deficits and by running probes for five days we can usually identify where a learning disability is actually occurring.

Let me show you some of the kinds of things that we've got here. What we've done here is, kind of to respond to Jerry, we've looked at these movement cycles involving an adult population taking a large enough sample to make generalizations, secondary classroom regular kids, secondary classroom special education, regular elementary classrooms, and elementary special. Now I point out the reason why we need to use the function of log rather than arithmetic because we're interested in proportional changes here. You can see how we go through say letter serial, say letter random, you can see that say letter random causes a proportional change among all populations. Say sound also, say number serial bounces right back up. Here we're talking about 400 a minute for an adult population, we're talking about somewhere around 300 a minute for the secondary regular, we're talking about for the regular elementary around 250, and for the elementary special about 200, say number serial.

MC CARTHY: Were the specials LD or MR?

HARING: No, they were MR.

You can see what we're talking about here. Here we're talking about a fairly large group of kids in special education that drop inproportionately. In fact, both our populations drop inproportionately, our secondary special and our elementary special. That's an out of proportion drop. One would point right here in the use of capitals. We found out it was not a learning disability but it was a learning deficit. They hadn't been taught to use capitals. In that particular county, neither the elementary special classes or the secondary special classes used capitals. So that when it came to write capitals, they had an out of proportionate drop in their rate. Then, of course, the write number serial order and write number random. You can see that in every case, except here where there was a deficit, we got proportional changes.

BRYANT: They wrote small letters and that's just as great a discrepancy. So it sounds like it's more a dysfunction there than merely the fact that they didn't get capitals but did get smalls.

HARING: We would have to say I think for our elementary special that both writing small and writing caps had an out of proportionate change. This could very well be again a learning deficit rather than a disability.

CHALFANT: Could I ask a question on that task? Were they copying off the board? You could have a visual-motor integration breakdown, translating the visual system into motor.

HARING: They were copying from sheets.

Here is a learning disability child. This is Tommy. Tommy's a fourteen year old kid who was referred to us in learning disabilities having some problems. We always find out what is the normal rate in the regular classroom he came out of. In this case it's the normal for a number of regular classrooms, the median rate we would expect. Here, he's close enough to it that we wouldn't argue, it wouldn't be a functional difference. And that is on say letters in sequence. In say letters at random he's close enough, in fact he's right on target. In say sounds, we found with Tommy what we thought and what we labeled as a deficit. We ran say sounds for five sessions, not necessarily for five days. On the fifth session he came up to say sounds. On say numbers in sequence, he was slightly below but not of a great concern, although it is significant here that he did come up to the rate after five days. On writing letters, in fact, in all of the writing tasks, we could say from this after five days, although it was coming up, it didn't come up to what was expected of him, if we based that expectation on the median performance of the class. We ran five days on all the writing tasks, the write letters small in print, writing letters capital print, write letters small cursive, and write letters capital cursive. He did not come up. It looks like in one if we had kept on going, he might have come up to desired rate. We would probably, at least for our purposes now, and by our purposes I mean for remediation, we would probably circle this area and say that there is a learning disability. I don't mean to beg words semantically with you but that's the way we would make the discrimination. The deficit will recover after about five sessions and a disability will not recover in five sessions. And we need to go into another area of analysis.

JOHNSON: And no shift of instruction or anything?

HARING: No shifts of instruction. Just the continued rate.

I want to say that we've really discounted the real importance of straight drill in the sense that we don't use straight drill as often as we could. And we've found with running a lot of probes, continuing probes just on the straight movement cycles that drill has quite an effect. Then, carefully planned practice exercises have an additional effect. So with about three tactics we would start first with writing. We would continue drill in order to monitor, would introduce a practice carefully designed to use the skills that are involved here, and then would probably introduce some instructional sessions. With this, we have had at least at this point very good luck in bringing back performance to the desired rate.

CHALFANT: I'm really happy to hear you say this. In Nebraska, we had a little girl who had writing problems, She was left-eyed, left-footed and led with the left side. We had her write on the blackboard and within five minutes printing with the left hand was a good as printing with the right hand and in ten minutes it was better. I think that responsiveness to instruction through drill and practice is a very nice way of teasing out the variables which may be operating.

HARING: We started to use three basic principles that work with kids: drill, practice, and overlearning, because overlearning reduces the chances of finding a kid coming back Monday wondering what he has. So that if we use these three, then by careful analysis of the program you can usually get at an instructional procedure.

KASS: My rough rule of thumb has been about eight sessions, so that's fairly close.

HARING: Yes, that's fairly close. To show you some probes and show you how probes can quickly. . .this can be done over a matter of a week. So that we are talking about identifying kids with precision and validity that scares you. We can do it in a week with just one-minute probes and it's not a costly process.

JOHNSON: It smacks a little of Van Riper's technique of trying to decide whether or not to take youngsters into speech therapy. If after 3 or 4 specific inputs the child doesn't modify his articulation, you take him in for therapy. If after 3 inputs you can modify that articulation, you assume he will progress with normal stimulation. We've wondered about a similar procedure for trial teaching of letter names. Instead of using typical reading readiness tests, I think that some trial teaching of this nature might help in clearing the subject of "deficit" versus "disability."

HARING: I really agree with that, Doris because we've tried using all the tests and they just don't pinpoint as well and this is simple.

MC CARTHY: And really says to the teacher, should it be more of the same or should it be different?

HARING: Yes. Right here we would tend to keep going in this the sound area.

BRYANT: Well, this would take a little less than two hours scattered over a week.

HARING: Yes, a little less than two hours of the teacher's time. We've had in the regular classrooms where we've returned kids, we've returned kids that are referred to us for learning disabilities. We've taken our graduate students and they have been with the child in our classroom. We have about 140 children and 14 teaching stations. And the graduate student returns with the child to the classroom as we reintegrate the child into a regular classroom or a special classroom. And at that point the graduate student will work with the teacher in terms of probing other children. The teacher will say, well, I'm just about ready to refer this kid. Well, let's look at him in terms of some of these simple probes that we have. The graduate students are able to carry that off. They've arranged it so that the teacher will ask the child to come a half hour before school each day so some of these probes can be run. Usually we can determine which ones are the stubborn areas. This is a stubborn area. This is not responding to drill and we need to do more.

JOHNSON: We have been wondering whether activities of this sort also might tell us about a child's developmental readiness for certain remedial techniques. For example, we noted that some five year old children, despite intensive training in music, did not do particularly well on the temporal organization tasks (that is, perception and memory of rhythmic patterns). Perhaps some of your techniques could help us in determining whether a child was ready for a particular activity.

HARING: We've sort of been doing some interesting things with some of the traditional methods. It is scarey to think that you do something and then you find out that something was done in 1930 that is better than what you're doing now. This sort of thing did happen to us and it's happening to us all the time. The Hegge, Kirk, and Kirk drills are quite good drills particularly for sound and I've got some pretty good evidence to show that. Yet we've had a whole lot of programs come out with the sounds.

I'm just showing you the practice phase of the experimental conditions set up for using these drills. We use an explanation and demonstration of vowel sounds and type of word in which it is found. Then we gave an opportunity for practice by the student in giving vowel sounds several times, then reading of selected words after sounding each of them out, correction by investigator of errors, repetition of corrected response by the student. This child was out of the fourth grade, had some very severe reading problems, actually wasn't reading, and we thought let's start with the decoding procedure just working with sounds and see what would happen. I don't have data on into the reading, but we did take the short vowel sounds. We didn't use the whole drill but we used the sheet 12 (give sound of isolated vowel), sheet 16 (give sound of medial vowel and CVC words, consonant/vowel/consonant words), sheet 17, (read the consonant/vowel/consonant word). Then we moved to the long vowel sound systematic drill as instructed in the Hegge, Kirk, and Kirk: Sheet 12 (give sound of isolated vowel), Sheet 18 (give sound of medial vowels in consonant/vowel/consonant/silent E words), Sheet 19 (CVCE words the same as in sheet 18, all of which are nonsense words). The data here sort of speaks for itself. Again we're using rate. This may be the first time that the Hegge, Kirk, and Kirk drills have been charted using rate on 6-cycle semilog paper. This is baseline and then the phase changes. The drills were given pretty much as instructed by the 1969 reprinting of the Hegge, Kirk, and Kirk drills. We are working now with sending all of these. . .

JOHNSON: I like those labels. Manager.

MC CARTHY: I like your terminology. Instead of calling him a victim or a subject or a something, you've got protege.

KEOGH: And manager.

HARING: This is one of Dr. Lovit's students who did this and it's kind of exciting actually. During baseline, we had a median rate of errors of 13.1 errors a minute with the median rate of correct responses at 10.8 a minute on these drills. All we did here was introduce the Hegge, Kirk, and Kirk drills. And we ran another four days and we just reversed that on the isolated short vowel sounds to 25.9 correct responses a minute and the error rate dropped way down, in fact it dropped out to zero. But the median error rate was 4.1 over the five days.

Cindy again is the protege. Short vowel sounds medial positions, and the phase change or the independent variable was the Hegge, Kirk, and Kirk drills. In baseline, we had a correct rate of 14.4 responses a minute on the short vowel sounds and we had a 9.8 error responses per minute. The drills increased correct response rate to 27.2 a minute and dropped errors out. Whenever we see this, we see that the drills are having a very dramatic effect. I won't go through all of the details and you know how to read this. This is read CVC words, isolated short vowel sounds.

This is Rollin. Rollin is out of the 6th grade, by the way.

MC CARTHY: What are your reinforcements?

HARING: No reinforcements. We've stopped reinforcements.

JOHNSON: I'd have to also ask how many times are those sounds said by the instructor before. . .?

HARING: The instructor here has been reinforcing correct responses, just saying, "yes", "good".

WIEDERHOLT: The reinforcement isn't really taken out of the picture because doesn't the child see the record of performance?

HARING: No. He doesn't in this case. But it is debatable. One can never rule out the effect of "good" as a response to a correct response.

MC CARTHY: How much time per day on remedial instruction?

HARING: We ran 20 minute sessions. I think the typical session is the half hour session with the drills. Is that correct?

MRS. KIRK: Not necessarily, it depends on the child.

HARING: In both of these cases we ran 20 minute sessions.

I have a little reversal data I brought along because reversals are always thought to be such serious problems. Actually they aren't a real sort of problem. The most common reversal is the d-b reversal and our instructional session here lasted only about two minutes and we ran them two minutes per day. They asked the child to give the word and they pointed out wherever he made a reversal that this is a "d" rather than a "b". We worked here with show dam and bam cards. We started by working with the dam and bam cards. Often he would get the "d" and "b" reversed. Here the instructional session was showing always write a "d" this way with the dam and "b" this way with the bam. Here I can show you percentage data. Here with final "d", initial "d", just straight instruction, and this is without instruction. It maintains. And it maintains in the post-test. This kid did run successively over 70 calendar days. With daily practice, he maintained the behavior.

MC CARTHY: Daily practice sessions of how long?

HARING: In this case, this is the length of time it took him to go through the cards. This is a ten year old.

SENF: Do you do anything with the reversals that are not strictly mirror reflections, for example "was" and "saw"?

HARING: Translocation? Is that what you call translocation?

SENF: I don't know. There's a recent article in *Cortey* that shows that mirror rotations are not the same or at least are not correlated with the "was-saw" type of reversal.

JOHNSON: I think Frostig would say that the "b" and "d" involve only one figure relation to body whereas words such as "saw" or "was" involve two or more figures in relation to the body.

HARING: We do have some translocation data and it is pretty much the same thing.

Another set of teaching procedures that we have data on that I did not bring was with the Slingerland drill. Working with the Slingerland procedures affected the reading word (correct and error reading word) on Lippincott and on Ginn reading series. It had some effect on Palo Alto with one child but no effect with another child on Palo Alto.

JOHNSON: I wonder about the nature of the reading vocabulary in those books in relation to your findings.

HARING: So that it is strictly an individual matter and it's the procedure you use in teaching, the drill procedures you use, all this is very much an individual matter. And it's up to the teacher, as sort of probing of the procedures he may use, with the continuous monitoring of the performance, correct and error, that these kinds of decisions are made. And at the present time, I believe that's the best shot for the remediation of learning problems, the very sensitive instructional responsiveness to the child and his individual performance characteristics. There's no real way that I can see that we can provide that kind of sensitive instruction without maintaining daily performance records on the child. So we've been proceding in this sort of funky way, if you will pardon the expression, because it really doesn't have the kind of model or framework that I'd like to have it have. It would make it have some respectability.

MC CARTHY: Could we get some new jargon? That would make it respectable.

KEOGH: Would you comment further about the distinction between deficit and disability and the remedial generalizations from that?

HARING: If continuous drill for one minute, if the child doesn't respond into a fairly steady increase in correct response rate over five days, then there is a culprit there, kind of a stubborn performance pattern. Most of us will run it another five days and see what happens. We'll run the same exercise.

KASS: I call that a bad habit.

JOHNSON: Or the other thing you can't forget is the failure to have had the opportunity for rehearsal. If you just visit those children in classes, if they've not responded and the teacher hasn't called on them, they haven't had the exposure to see what learning can take place.

HARING: But it is true to follow up on that, Doris, a lot of what we've been calling disabilities are simply deficits.

JOHNSON: I agree. Or what we have sometimes called delay versus disability. And I think that's one of the very important things we need to do is to try to determine what may be delay or disability at the kindergarten or first grade level.

HARING: So that our procedure then, just to summarize, is when we see a child we do our probing in all these areas. It's the first thing we can do. And we do it pretty much the way that I showed you. That's an efficient way and we're looking for efficiency. Then we pick out those areas that after five days, with one-minute samples of performance, don't respond. And we begin to look at that a few more days, where we continue on with all others and we begin to introduce whatever independent variables we're going to introduce on those areas.

JOHNSON: Do you have a list of those? Like secondary probes and ways in which you'd shift?

HARING: We have a list of the probing that we do.

JOHNSON: If this doesn't work, then. . .

HARING: The next procedure then is to introduce an instructional program probably that arranges whatever area we're talking about, arranges the cues in sequence starting with the easier and working gradually to harder. If we find at any time that the child makes a correct response or a series of correct responses where he shouldn't have, then we begin to be suspicious of motivation.

JOHNSON: Before you start rearranging, do you ever just modify the intensity of the stimulus-so that, say visually, you make the print bigger; or auditorially make it louder--starting to vary the parameters that way?

HARING: We haven't done that so much. We started with arranging, sequencing the curriculum.

KEOGH: I think I'm bothered by the same kind of thing you're getting at. As I understand it, you have one-minute probes for five days, and if you don't get change you go to another three days or five days giving the same thing. I wonder if you had varied the task, would you have gotten a change? In other words, is your assumption of disability really a function of the task, and not necessarily of the child?

HARING: That's a good point. It allows me to say that this is only the dependent variable. Any variation that we do we continue to use this and we continue to run the probes. For anything we think we do with the instructional variable or the independent variable, we would look at the effect over this. In a sense what we saw here were just a series of probes. The other data that I had is where we actually went in and used the Hegge, Kirk, and Kirk drills. That was an independent variable. So we're willing to try anything we can, but usually the reason we haven't gone to increasing the intensity of the stimulus is because we've had so much success with just rearranging the sequence.

KEOGH: I hadn't even gotten as fat as you had. I was still talking about the dependent measure. I can understand the nicety of keeping the same dependent measure. It gives you much better pictures of what's happening in terms of that measure. But I still wonder, if the child doesn't do well in that particular way of presenting that task, what if it were modified slightly, still conceptualizing it as the dependent measure? Is there variation then?

HARING: I guess one of the things that we'd want to do first is extend that dependent measure so that we would accomodate more of the kind of questions you would be asking. I think as we get more experience with probing, we'll add probes. As we get more information from further analysis of performance in these basic skill areas, we'll add more probes. So that I think what we'd do is maintain the same procedure as you know taking our dependent measures but add more and more significant probes. I think that's the direction that we would be going. But, we've just started this probing thing in the last couple of years, and it's been very rewarding in terms of the efficiency with which it gives us.

CHALFANT: I would like to respond to the probe and then tie into Dr. Strother's question this morning about how you use process for decision-making. In using teaching as our primary diagnostic tool we set up teaching probes. Let's say the child fails on a given task in learning how to read. We had a 20 year old southern come in who couldn't read and a 20 year old man from St. Louis who was also a nonreader. What we did was conduct a process analysis of what was involved as well as a procedural analysis of the failed task. Then, knowing what the variables are in reading a word, we set up a series of three or four probes with each variable ruled out and compared between task performance while controlling the variable. For example, we'll take vision out as a variable or take out sound as a variable and compare performance between tasks. Sometimes this shows that a child's performance will improve when you test one modality over another. If the child does better in the auditory versus visual, you might take a compensatory instruction route and teach him auditorally in contrast to doing the remedial work in the visual area. The idea of taking a task and determining what variables are operating gives added information for planning. A test can't really tell you how to teach a child but if you teach a child several different ways, you can often determine how he learns best, where the problems are and whether to compensate, correct it, or do remedial work on the process. I really enjoyed what you've presented here--the way you're getting your data and your recording I think is the kind of preciseness we really need.

JOHNSON: And I think that our two branches of the field can really come together there. That is some of us who have been working on cognition and processes really need to define our probes more specifically as Haring and others have done. I woke up in the middle of the night thinking "My word, I'm a behaviorist".

Could we not systematize our probes--that is, combine the techniques from the behaviorists with the cognitivists? For example, in remediating a problem such as auditory discrimination, the clinician tries a series of probes to see which form of input might modify the child's behavior. For example, she might try intrasensory stimulation (asking the child to close his eyes), or she might try multisensory stimulation, or she might modify rate, etc. What we need now are the techniques for measurement such as Norrie is describing here.

CHALFANT: There is another problem here. We have to gather data at two levels. You've already commented that in training teachers they have to have some system that is fairly simple which they can use. We need one kind of statistical data gathering procedures which can be used daily by teachers in a realistic way. At the same time, researchers need more sophisticated techniques which yield more detailed information. I think we ought to think in several dimensions. What can teachers do and what can researchers do to gather the relevant data?

JOHNSON: But part of this the intuitive teacher does, and if we can make her more aware of what she did to shift to make that child learn, it may facilitate the instruction.

CHALFANT: I love to teach and train intuitive teachers, I wish I could recruit more of them. Master teachers often have difficulty verbalizing. They can't tell other people what they do. However, we can take some of these very simple procedures and teach them to someone who may not be as intuitive. We need to train teachers to make intelligent decisions about what to do, and when to stop what they are doing, and begin doing something else.

JOHNSON: But if you take the definition of woman's intuition, which is a series of synthesized perceptions based on past experience, and you take those perceptions of behaviors they saw in a child and related them to techniques that worked, they can begin to verbalize principles. Then maybe you can shift away from straight intuition.

HARING: I do have some cognitive data. This is a simple little study. This kid was actually referred to us and it was out of junior high, a ninth grader because they couldn't contain his physical aggressiveness. He was hitting, scratching, poking, or pinching at the rate of between once every five to ten minutes. That's pretty high for a high school kid. This is a hard kid to sit next to. All the teacher did was say to him two things: one, keep a record of the number of times you hit, pinch, scratch, or poke and if your record is consistent with mine I'll add ten minutes to your break. And that knocked it right out. That's a cognitive approach.

KEOGH: There are two things that bother me now. One is how does what you find there give you any direction as to what to do, except to define the area which needs change. And, second, I really would be interested if you have some speculation about what you think might explain this.

HARING: I haven't got any explanation to explain that. But I think that it's fair to respond to where do we go with this kind of information. I believe that where we're going with this information is more accurate, even microscopic focus on exactly where the deficit or disability is, what exact movement cycle is it occurring in, which gives teachers a way of applying this as a technology in teaching. If we work out the accompanying schedule, the curriculum sequence, and procedures that would make it possible for a teacher to balance all of these plates in the air, by that I mean to teach 20 children who are very individual in the way that they learn, that would be the next step. Teachers will say, I can't do it because I haven't got time to do the kind of precise probing, the arrangement of materials, acquiring the resources that you're doing here. So that the next step here is to build on the effective resources, to provide ways that teachers can increase their teaching repertoire, and work with them in terms of grouping, in terms of scheduling, and in terms of resource people. So that if you ask me where would I go from here, I would have to respond in that way, but at no time would I become more general or become more inferential in my response to these kinds of data. We're not ready to do that.

JOHNSON: The initial phase of setting up the tasks is done somewhat on a developmental basis but there are always value systems involved in deciding what that child should do.

HARING: But I know that there are cognitive short cuts, that's what I'm going to call them, because I know that teachers will say certain things or run a certain procedure and it will make a tremendous difference. In some instances, it will exceed two or three weeks of drill. Now if we find out what those cognitive short cuts are, we're going to keep them to ourselves.

SENF: Can I ask you about when you would be ready to speculate further as to what kind of other model would explain these data. We seem to be already so far away from the simple reinforcement model unless you say, rather tortuously I think, that the knowledge is reinforcing and, hence, the child's own record of what he's doing is reinforcing. Frank Hewitt related an interesting and, to him, or at least to his theoretical position, a disturbing anecdote in a recent talk at Illinois State Pediatric Institute. A child in his programmed classroom was resisting his arithmetic lesson. He had ripped up his paper and thrown it on the floor. Frank said they removed him from the situation and placed him at the more desirable media table, I believe it's called. According to reinforcement theory, the child should have learned to escape math. But the child didn't treat it that way. Indeed, the child moved to the media table, interested himself, used the time advantageously and then initiated his return to his arithmetic. Simple reinforcement theory is just not borne out, perhaps more because of the theory's over-simplicity than because it is essentially incorrect. You seem to be flirting with some of the same kinds of things and I wonder whether an ennunciation of the underlying principles here may move you further. Do you think about that?

HARING: In many ways. I've been responding very positively to what Jim and Barbara have been talking about, because it's indeed possible that down at the summation end, that's the response end, that's where all these processes summate. We have to realize that. They summate into some kind of response. But as we get more information about mapping out the patterns of responding and as we begin to work jointly between precision measurement and psychological measurement. We can put this together in many ways. First of all, we can put it together like this, in a real cognitive way but we can also put it together by computer storage banks. We can begin to look at this in terms of ways we index certain performances and the ways in which we see these performances being measured by more complex psychological measurements and the way in which we see the same performance being measured by this very simplistic way of counting and getting the rate of the movement cycle. We're going to be able to put some of these patterns together and as you say the frustration comes from who's going to get there first. No, I would share any information I got. In fact, we share things we don't even have.

STROTHER: Before you start, I'd like to make one comment. We should attempt to reach some degree of crystallization, if we can, of what seem to us to be the most critical questions in the field of learning disabilities. So I wonder if you'd all be thinking of that today. If we could formulate, perhaps before we adjourn this afternoon, some specific questions around which we would like to frame our discussion tomorrow, this may bring things to a head a little more clearly. If you'd do that and jot your suggestions down and give them to me, I'll work them over tonight. Then we can start off tomorrow with something that may bring our discussion to a head a little bit more clearly.

All right Jim, go ahead.

INPUT LECTURE BY JAMES CHALFANT

Many of the presentations have begun at a conceptual level and talked about research, methods, and theories. What I would like to do is to begin by trying to reflect the questions that people ask me when I consult in the field. I would like to center most of my comments around the questions that came from Educational Service Unit #9 which is an intermediate administrative unit in Hastings, Nebraska. They have psychologists, a couple of speech correctionists, one remedial reading teacher, and that's about it. They serve an area 50 by 70 miles and have 15,000 children. They want to know how they can best get the job done.

In terms of service, I find that in Nebraska and everywhere else school people are under great pressure to serve large numbers of children with learning problems regardless of the causes of those problems. They have to serve the children and they really don't care what caused those problems.

Second, administrators and teachers, who are under pressure, are willing to try anything that comes along. Remedial reading came along a few years ago in Nebraska and they tried that. Administrators gave these teachers 150 to 200 cases and remedial reading didn't work. So they're opposed to remedial reading and now they want to give learning disabilities a try. The same thing will happen again if it isn't controlled carefully. This is one of the problems with this multiplication effect that bothers me. We can take something that is effective, like remedial reading can be, and build in failure from the beginning. We are trying to avoid that problem with learning disabilities in Nebraska.

Third, they are confused about learning disabilities. They think any child with a problem is a learning disability. They do not understand what psychological processes are, dysfunctions in these processes or how these dysfunctions affect learning in reading, writing, arithmetic, language, problem solving, and so on. They aren't the only ones that are puzzled by these things.

Guidance is needed in establishing services for children with learning disabilities and I have nine areas listed here that I would like to mention. First, is the need for a conceptual model, as opposed to operating on a crisis basis with children. If a teacher has a head banger, they refer him. One boy lit fires in school and they referred him. Educators must have some kind of conceptual model or models in which to relate all these children with problems.

Second, they're in dire need of some kind of administrative organization, some kind of diagnostic center which can get the job done. They need to use the personnel they have as efficiently as possible. This whole question of how you organize and develop a rural area and utilize people in it is an urgent and important area for study.

Third, they need guidance on screening and identification procedures.

Fourth, they need help in diagnostic procedures. They need procedures for intelligently finding out what kinds of learning problems children have. We have been using informal procedures, how to go in, take the child's book in arithmetic, sit down and begin studying the child, not with batteries of tests. We have to take rural areas like this and begin with whatever it is they have. They aren't able to give the I.T.P.A., and I haven't had time to teach them yet, so I show them other ways of getting at some of the same kinds of information informally. It's primitive but there is a spiral effect. You can't take a North Shore program in Chicago and transplant it in Nebraska. They don't have the resources to support it. Eventually, I think they can evolve high quality services.

Fifth, they need help in planning individualized instruction. One mistake we made was walking in and giving 20 suggestions to a teacher. You should give the teacher one suggestion and it might be carried out. How do newcomers to the field begin planning individualized instruction? They are confused by what they read on methods and they don't know whether to give the teachers kits, behavior mod training, or what. When should they work with a child individually? When do they work with him in a group? How do they analyze his problems? How do they select their materials? What skills do the regular classroom teachers need? What skills do these resource people need? These are the questions we need to answer.

Sixth, in terms of intervention, when do they go a developmental route in training? When do they move into the corrective level? When do they go remedial? When do they go compensatory? They want help on intervention.

Seventh, they also need help in measuring the effectiveness of what they do.

Eighth, in terms of in-service training both regular classroom teachers and, of course, the special teachers need in-service training.

Ninth, guidance as to how learning disabilities fits in with speech correction, mental retardation, remedial reading, and regular education. You just don't want L.D. out there by itself; it has to fit with the total school program.

These were the major questions I was asked during my first two hours in Hastings, Nebraska. It is important to give guidance so schools can set up meaningful programs.

Most teachers are good readers but sometimes they become confused about what they have read, and they're not quite sure what to do. One reason is they don't have a theory. If teachers had a theoretical model, they could better integrate what they read.

Also, they've been holding meetings, that's how I got out there. They're holding regional meetings and state meetings and their people are going to national meetings. In terms of special study institutes, they've had those too. They're setting up pre-service training at the University of Nebraska. We've been doing in-service in Hastings for two years. The state is coming up with regulations and guideline, they are hiring someone to supervise the learning disabilities across the state and they now have legislation. We're setting up consulting teams to operate out of the Hastings area to help with the other little towns around. There are many things we could do to help places get started with the little bit that we know.

That brings us to our most important point. Exactly what do we want to tell these places? We've raised a lot of questions here the past few days. What do we feel comfortable with telling them in Nebraska?

This question brings me to the area of research. I would like to make some brief comments on research. My first comment is that the average researcher has too many jobs. Usually he advises students, teaches courses, has many administrative functions, is a consultant, has the inevitable committee work and occasionally gets around to doing his research. I think this is a problem. We're schizophrenic in our jobs and we really don't do quality research because we have neither quality time nor quantity time.

Second, most projects are very modest. They're short-term, done in our spare time and they're rather simple kinds of things. That's all right, but the problem many researchers have is difficulty in selecting a research area. They sort of skip around, do a little bit here, do a little bit there and make small contributions. This is in contrast to setting up a programmatic area of study, systematically doing a series of related studies, having doctoral students follow in succession, and really learning about an area. The universities reinforce professors publishing. There's not much payoff in doing a 5-year study coming up with one publication in terms of rank and pay if you're an assistant professor just starting out. A lot of people spend their time writing up articles of no difference. They make five articles out of one piece of no difference research. Then they get promoted. The reinforcement system isn't quite right. Longitudinal research is a problem. How do we get longitudinal programmatic research started?

We talked about the lack of research methods and technology for many problems. We're using stone age tools. Another thing I've noticed in my own attempts to do research or development kinds of things, I am sometimes limited by my method. Perhaps people who use other methods are locked in to certain kinds of projects because of the methods they use. How many times has a doctoral student come up with a dandy research question, only to find that neither he nor his advisor are able to come up with a research method to study that problem? So, that problem is dropped and the student picks a method that somebody else has used and takes a lesser problem to study. That goes on in the field as well. When a student comes up with a good problem, if there isn't a method, then build a method. And if it takes two, three, or four years to do a thesis instead of one year maybe that's what needs to be done to get that information. If that information could be obtained easily, we would already have it.

Another point here is people tend to work alone rather than in teams. I tend to view most interdisciplinary efforts as parallel play rather than any kind of interaction.

We don't encourage researchers in other fields to work on our problems. We don't set up contingencies for them to do research in the basic research areas in psychology or biochemistry. We should encourage independent researchers as well as collaborate with them. Most of us are dealing with applied problems. Still, in terms of basic research, there are many things that basic research could do that would give us good leads which we could direct toward applied, functional problems. Another reason we don't collaborate is we aren't trained to collaborate in our institutions of higher learning. We're trained apart and we work apart when we're in the field.

Statistically it's not a question of whether to use parametric statistics or nonparametric statistics or idiographic research. The question is knowing when to use one and not the other. We are dealing with atypical populations and we really should have some flexibility in selecting our analysis of procedures.

Should we be doing behavioral research, cognitive research, etiological research? I think the answer is yes. I think any question at this stage of the game is fair game as a research topic and that it would be murderous for us not to encourage diversity and creativity in attacking problems from many directions. I don't care who gets there first as long as somebody gets there and tells me how to get there too. I am very frustrated when mothers bring their children in and I can't do anything very much to help the child or the mother. I think we really should encourage diversity in problems.

There are a number of research questions we should try to resolve:

First, how can we identify our research priorities and specify them and how do we support these priorities?

Second, how can we organize or mobilize existing personnel? This is a big problem. How do we mobilize our resources to answer the questions asked by our service personnel in the field? I really think we should listen to them and get with it.

Third, how can we stimulate the research and development activities across the United States on our key questions? How do we get people moving, and working on these questions?

Fourth, how can we improve existing methodologies that we have, and develop new methodologies and technologies? Can we have conferences and institutes and symposia?

Fifth, how can we disseminate the results of our work rather than have a 20-year lag before it's implemented?

If the service people are asking the questions and if we can improve our research efforts so we can really tell them something of value, then we come to the question of training. I think what we need at this point in time is not doctoral people, but program developers in the schools to straighten out the confusion out there. I think we need experts in diagnosis and remediation who have the capability of going in, setting up the special education programs, and operating and supervising those programs. I think these people have to be trained administratively, and trained as problem-solvers with children. A two year master's degree program, an advanced certificate, or an educational specialist degree would let a post master's student get the advanced work in diagnosis, remediation, and supervision. We need leaders. Most of the leadership I see in the field is coming from supervisors in the country. They're the ones that are organizing their teachers and mobilizing resources. I think at this point they are really key, and I'd like to see emphasis on supervisors as well as on teachers. In California, I understand they are retreading teachers from regular classrooms for special education. What those teachers need is somebody to give them in-service, supervise, diagnosis and remediation. They could really help in a place like California where they're putting regular teachers into those E.H. rooms.

We must communicate our major concepts and ideas to regular education, to other areas of special education, to medical groups, guidance counseling and so on.

We really ought to look at how we're training teacher trainers and how we're training researchers. What entering behaviors into teacher training or research or both should these people have? What skills do they need? Our doctoral programs are very haphazard at present.

For the past ten years or so we have acknowledged the complexity of our problems, we have worried about our ignorance and lack of research, we have criticized our primitive methods and technology, and bemoaned the lack of financial support from Big Brother so we can resolve these questions. And despite all of this I think the field of learning disabilities has made some impact on American education. What I feel learning disabilities has done that has been most valuable is that we've integrated knowledge regardless of its source--psychology, educational psychology, speech, deaf education, Mental Retardation, blind, geriatrics, behavior modification, guidance and counseling, regular education, medicine, administration and engineering. In integrating this information it has become more than the sum of its parts. In some cases we have made more practical applications of the knowledge from certain fields of study than those people who developed those ideas initially. First we've utilized concepts, approaches, methods, ideas, and materials and equipment from other fields in very new ways. For example, we've taken the Fitzgerald key from the deaf and taught a hearing child who didn't have a language system. I think this kind of integration has perhaps contributed to the dynamic impact of the field of learning disabilities.

Secondly, we have focused attention on intraindividual differences rather than differences between children. Looking at the assets and deficits within children more precisely has helped weaken the categorization of children. It's now less clear that a child's retarded or learning disabled or emotionally disturbed when you start looking at assets and deficits in more precise ways.

A third contribution is that this field has helped advance the concept of individualized instruction as much as anything else in prescription teaching. In terms of differential diagnosis, we have highlighted intra-individual differences in children and the result is that people from learning disability programs are making specific comments and suggestions which teachers are able to understand and use.

A fourth contribution is the focus of attention on central processing functions and their relationships to learning. We've raised many questions for the clinical people and the experimental people in psychology. What are these processes? How do they relate to learning? What causes the dysfunction? How do these dysfunctions relate to failure in the classroom? What can we do about them? In the past much of the process information has been in the laboratory with neat little projects and studies and no one ever tried to apply it in a regular classroom. I think this field has come along and has applied the process information into the classroom. We are beginning to make it work in terms of attention, memory functions, and other things.

A fifth contribution is in seeking intelligent ways of deciding how to teach a child. An I think this began by trying to link test results to methods. We have moved a long way from just linking a low test score with placement in a class for the retarded. That was the beginning. Now we're really trying to look in a differential way. In addition to formal tests, we're using probes, we're starting to manipulate variables. We're going to make the teacher a scientist who views the teaching act as a diagnostic tool. We are putting some effort into finding intelligent ways of deciding not only what's wrong with the child diagnostically but also how do we teach him.

Sixth, we've raised questions about traditional grouping practices. We have a child with an IQ of 75 who's in a regular classroom making all B's and C's. He would've been in a retarded class five or six years ago. You take the child who's visually down, whose visual processes are not remediable after two or three years. A child of the same age may be auditorially down. We've decided that the child who's auditorally down is remediable so you give him an auditory program. We decide that the child who's visually down is not remediable, but he needs auditory compensatory type of program. So we put children with two different deficits who need the same program in the same classroom. In terms of grouping children I think we're having an impact.

Seventh, in teacher training, we don't just tell your students, this is how you use the Hegge, Kirk, and Kirk drills. We also teach them when the Hegge, Kirk and Kirk drills are appropriate. Instead of teaching how to use specific methods, we're promoting the idea of problem solving, detective work in terms of cognitive styles and selection. Exploratory work on learning and manipulation of variables is coming across in our teacher training programs. And this ought to be done in regular education as well.

Eighth, we've given impetus to diagnostic and remedial centers across this country. Learning disabilities in many cases is a stimulus for the development of multi-disciplinary diagnostic centers. In other cases, where there is a center and learning disabilities comes in, we are influencing practices within those centers. They aren't doing the same kinds of things that they used to do in a lot of these centers. I think we're having an impact there.

Ninth, in terms of training, we're turning out a more versatile teacher, personnel who can see behavior, understand what they see, understand what they hear, problem solvers and doers. A lot of these people graduate and can work as itinerant teachers, consultants, special class or resource room teachers.

Tenth, we've developed a few methods and techniques for assessment in the past ten years, a few techniques in remediation, and some interesting ways of administratively organizing and staffing programs.

Finally and most importantly, during the past ten years I think we have helped a few children along the way.

Our efforts represent a beginning. At this point in time, we feel, and rightly so, that we haven't gotten the job done. We haven't accomplished all that should be accomplished. In fact, we haven't accomplished very much at all in terms of the scope of work that needs to be done. I think that as a group we're growing up rapidly in comparison to the history and evolution of other fields in special education like that of the deaf and the mentally retarded. Look at the growth in our field over time as compared to the growth in other fields. There are reasons for that. We do have an advantage, we are standing on their shoulders, but we don't have the luxury of time that they had. We are going to have to produce in a hurry. In the era of cost effectiveness and multiplying effect, we're going to have to produce. As a field I think we've gone through a childhood phase. Many of us have been egocentric and we've played by ourselves. We've had our tantrums and a lot of spills and accidents and we've made mistakes. I think we're starting to move into an adolescent period and we're still going to be awkward and pretty clumsy. But if we are to achieve any kind of maturity with some measure of competence, wisdom, rational thought, and grace and become a dynamic field, I think we have to continue to integrate knowledge and conceptualize. We have to refine our methods and technologies to keep pace with our theories because right now our theories are out in front of our practice. We have to increase the relevance of our contributions for others who work with children.

I think most important of all is our attitude. There comes a crisis in a battle, in a football game, in a basketball game when a team can either win or lose. I think, at this point in time, our field is at such a crisis point. Nebraska didn't go the length of the football field in the last 90 seconds to win the game against Oklahoma for no reason. They had an attitude. They were number one when they went on that field and they intended to be number one when they came off that field. And I think professionally, we should take a long hard look at our attitudes as a field of study. We should try to keep our curiosity, keep asking questions, try to remain creative and flexible, maintain our problem-solving orientation, and continue to show respect for one another. I think the enthusiasm that this field has generated is another attitudinal thing I'd like to see continued.

It is time that our field pulled together, that we got ourselves organized, and that we really go after all these questions that we've been asking for too long. I think it has to be a collaborative effort. The mutual respect that I have seen around this table, I would like to see all across the country among our colleagues.

HARING: I've heard several of you say that you have to have a model. I'd like to know why you have to have a model because I want to make a couple more comments about that. You've been working with people that come from where I live. Their major concern is to get their crops to yield and to harvest their crops before they get a hail or a windstorm. And I know that so very well because I've seen the heartbreak of these farmers when they've lost everything. Basically, they're empiricists. Nature has really shaped them to plant when the planting is right, to fertilize and water, if they're fortunate enough to have an irrigated farm. They've always interacted with their nature and with their yield in such a way as to treat it in a very individualistic way. The farmers that have survivied have done that. Now they do not have a model but they've contributed to models because people have studied their behavior. This is not just Nebraska farmers, it's farmers. They've studied their behaviors. We had a statistician from Iowa, Snidicker who developed the analysis of variance in the farm. What they were trying to do was to develop a seed that would tolerate the hot suns in Iowa and Nebraska and tolerate the dryness that we get in the summer there, so that that seed would yield in spite of adverse conditions. Through analysis of variance they found a seed that would yield in the hill country of Nebraska. They did careful measurement of yield. Why isn't this possible for us as we work with children with learning problems and as we investigate? Yesterday we looked at a continuous measure, but I think this can be even more efficient so that it's practical for use in the classroom. Why can't we refine conditions in the classroom in somewhat the same way as these farmers have done without a model?

CHALFANT: May I respond? Farmers have a model.

HARING: All right then, define model for me.

CHALFANT: Well, that was what I was going to ask you to do because I really don't have a problem with this. You have a model. You think along certain lines and I define that as a model.

HARING: You call that a model?

CHALFANT: Yes.

JOHNSON: And I would agree that the farmer has a model for looking at all the variables.

HARING: Let's talk about model then, because people are trying to convince me that we need. . .

JOHNSON: A frame of reference.

HARING: Yes, I'll agree with that.

CHALFANT: It's probably a language thing becuase I'm really not disturbed by this. I think you have a model and so does the farmer. On the playground children have these things to crawl around in, sort of iron affairs. It's a framework which helps them get from here to there. A model is a way of thinking. For example, if I could go to the stimulus and response model which a lot of people use, the question is. . .

HARING: Jim, not any more, we hardly ever use that. We use an S--R--R. There's a very significant difference. I want to point that out before you confuse any of the doctoral students.

SENF: As you point out Norrie, you use a different model than the S-R model, which is to say you do use a model. And it has unique aspects as you yourself have just stated.

CHALFANT: And if you train a teacher, you're training a teacher to use a model.

HARING: This is what you call a model.

Well, I'm a little embarrassed to be so naive but I've never thought of this as a model. I've always seen this as a research procedure.

MC CARTHY: Norrie, I would say that a model, (and I forced myself to formulate one when I was coming down here--this'll open the door because I wasn't sure whether I wanted to use it or not) is a collection of all of the influences that have shaped your thinking and probably help you predict an action in the future. If you really tried to take all the threads that have contributed to where you are now in your way of thinking, that's your model. At least this is what I would see as a model. It may be very useful for all of us to confront ourselves with all of the elements in the operational model with which we function.

BRYANT: To bring it down rather specifically, you remember you said that after you tried a child for five days or five trials using something and if it didn't work then you had to modify and change. Now it seems to me that you have to have some kind of model which would guide your changing. I think that is the model as it's been used.

MC CARTHY: It's your frame of reference or a theoretical formulation which undergirds your actions.

KEOGH: I don't think it has to be theoretical as there are a number of models which are probably atheoretical and don't allow any prediction. Might it be that it defines for you the parameters you want to investigate.

HARING: Precisely. In these cases we've talked about, it's always been empirical and I suppose other models are empirical, aren't they?

CHALFANT: If a farmer wants a yield and he wants to control the stimuli, he wants to water it so much or put so much in the shade or whatever. The question is, could he go out and count the number of rocks in the field or could he count the number of stars? What does he look at? In my case I have a central processing model. I can look at the stimulus and the response and so on but I think in a certain way. I look at the stimuli, the responses, the reinforcers, and the central processing functions. The questions are "What are you going to measure? How do you decide what you're going to measure?" How did I decide to look at the haptic process? I had a processing model to start with. Now you might have gotten there with a different model. Model is probably not a good term. We need a system for asking questions about which choice to make and it is this that I call a model. This is what I mean about problem solving. It is a way of asking yourself questions in order to make decisions. This is what I say to the people in Nebraska. In order to make sense out of all the variables that are operating, they must have some way of thinking. I have not pushed processing at them at this point. It takes a while. I'm operating in a very behavioristic way in Nebraska.

KEOGH: I would think that you must, Jim. It seems to me that there is a danger the other way. That is, it's fun to sit around and talk about "theoretical models", the underpinnings for these models are construct underpinnings, for which there are often few empirical referents. What referents there are are unclear and untested. It's great fun. But these models may be muddling, for the person who's trying to make sense operationally. I suggest that if we're talking about models for the practitioner, and I don't mean it as a putdown at all, we must talk about models as systems, not as theoretical models, in order to provide the parameters of a functional frame of reference. Nothing more.

CHALFANT: That's what I'm talking about.

KEOGH: But, when you say let's provide the teacher with a model, there could be a whole range of models. I think another word might be better, perhaps "system", or "frame of reference". I think there may be a danger is using a word like model.

HARING: It still isn't completely clear but I understand better what the function of the model is. If what you say is true, it helps the teacher have a frame of reference by which he makes decisions and selects materials.

CHALFANT: And to relate behaviors which are observed.

HARING: And ask questions.

KEOGH: So why don't we call it that, a system or a frame of reference. I'm must a little uneasy with the use of the term "model".

MC CARTHY: You know, I'm concerned enough about this in a very practical way. When Jerry and I were evolving a role for the LTI and for Jerry especially, we decided that one of the first things that he will be looking at in these 23 proposals for the model centers funded under Title VI-G is the theoretical formulation that underlies the practice that they're proposing to implement. Now it's going to be a difficult thing to tease out because many of these people, as Jim has said, have read this thing and they think that's a sharp thing to do, so they decide to try that, and they've read something else and they've got that in their proposals. So they've got a smorgasbord of practices that they're proposing to do, which may be drawn from completely contradictory models, but they don't know it. In other words, the proposal might include "a creepy-crawly" program. As Jerry looks at what they're proposing to have the children do, he can back that into a theoretical construct that suggests that we do have to start over from the beginning and rebuild whatever the processes are that are affected right now. We can't just go in and treat it behaviorally now, we have to go back and reconstruct. Then, even in that same program, they might have proposed another treatment based on an entirely different, a behavior mod or an operant model that is really in conflict with the other practice. I think that people need help in sorting out the frame of reference that they're operating from so that they're not operating in opposing directions. I don't know that the people in the field are concerned but I certainly am.

HARING: Well, you see the thing that amazed me and caused me to ask that is what Jim presented is exactly what I would present. If I went to Hastings, which is 42 miles south of where I was born and raised, I'd do exactly what Jim did. I don't even see any place where I would vary what happened but he's operating out of a process model and I'm operating out of what's probably kind of a funky empirical thing.

BRYANT: I don't think this arose out of Jim's processing model. I think that there's a different frame of reference there in doing that kind of thing.

KASS: I don't think we should be too afraid of words, and I think of a model as internal to the person responsible for the task. You see, theory really has to come out of some experience. Then once you have the constructs and the educated guesses, you then subject them to a further testing in order to revise; and it's an ongoing thing. Basically every professional person responsible for dealing with behaviors or deficits must have a frame of reference which they understand--even though they may learn the behavior modification model in their courses, they may learn the process model, they may learn the Osgood model, they may learn the Mowrer model. . .

KEOGH: But that's exactly what bothers me about the use of the word model. The things you've named just there are of such a diversity of levels of theory, of levels of application, however you want to put it, that they become almost non-meaningful.

KASS: You could call it systemic thinking or problem solving.

KEOGH: Norrie has a way of describing behavior that's beautiful. But what do you describe? Your way of describing behavior isn't a model in an explanatory sense. It's nontheoretical, it predicts nothing. It tells you just what's happening in terms of certain kind of predefined variable parameters. How you define those parameters is where I would think that the word models or the other ones you've mentioned would come into it.

HARING: We've come to see that precise behavior description, when measured over time, gives you a prediction because you use the trend line of the past five days and extend it on and if you don't change conditions. . .

CHALFANT: You see, Norrie, one thing I have is. . .

HARING: But you're right, it doesn't give you prediction.

CHALFANT: The question I have is how did you arrive at the task choices at the bottom of the chart.

JOHNSON: What did you decide to measure.

CHALFANT: We might have selected different task choices as a result of having different frames of reference. I am interested in how you arrived at those tasks as opposed to all the other things you might have done, and would I have eventually come up with the same things.

STROTHER: Would it be possible to look at it this way simply to ask these questions: What are the variables with which you choose to deal, and how do you conceive of these as being related one to the other. And it seems to me we could ask that question on different levels. You could say, if you're talking to the teacher, what are the variables with which it's important that she deal in looking at the child and in selecting the way of working with the child. But if you're looking at the researcher, you might say what are the variables that he chooses to deal with. Some of us will have a more restricted field, some a larger field, some will pick this part of the field, some another part of the field. But essentially what we're doing is systematizing our observations and hypothesizing certain relationships between the variables we observe. And as long as you do that, you've got a something that we can call by a single term, whether "model" is the right term or not.

KASS: Systems of thought.

CHALFANT: It has to be a frame of reference, a systematic way of thinking. There has to be some glue to hold all these things together, all these concepts, ideas, methods, materials. Otherwise, it's random behavior and a lot of what's going on in the field is random behavior.

HARING: I don't really know anything about conceptual models. I don't deal in that. But I do know that the quickest way to change behavior is to approach it directly rather than indirectly or rather than nonintervention at all. You start with that, and you start with what behaviors are direct behaviors and find those that are observable. Then you classify them in academic, social, language, and so forth.

CHALFANT: I would classify them differently. They might be the same behaviors. And maybe that is a point that might be productive to follow up at some future time. The psychological processes can be described behaviorally, and the tasks that I would generate from those processes may be the very same tasks that you would get to by another route.

HARING: You have to measure them eventually. And since measurement depends on observation, you might as well start out with what you can measure first. I didn't raise that as an argument. I just raised it to only ask the question of where you start. Do you start with process or do you start with the summation of the process?

STROTHER: Let's continue to reverberate to this later. But we're going to have to push on if we're going to get three papers in this morning. We'll undoubtedly want to come back to this tomorrow because I think it's a very basic question. Who is up next? Corrine?

INPUT LECTURE BY CORRINE E. KASS

I would like to treat the field of learning disabilities as if it had definable boundaries. We're not certain of definable boundaries or whether there is such an entity. Unfortunately, for every generalization which someone makes about a field or discipline, someone else could make the opposite generalization. What I would like to do is to look at some of the dimensions which are possible for defining such a construct. For everything we study, we can look at it in at least three dimensions--and if we could stretch to the limits of human intellect, we might even peer into a fourth.

What I'd like to do is divide my comments into four areas, (1) the concept of communication as a basic process in the field, (2) hope as the basic emotion in the field (not speaking now about children's emotions), (3) the perspective for the field, with the inclusion of both positive and negative elements; and (4) prognosis for the children with whom we deal.

First, then, communication as the basic process. I think we do this communication in two ways. One, we have developed a communication within our professional corps. Second, we have communication which is brought to others, to those outside the field, including other professions and the lay public.

I'd like to talk first about the communication which we have with other professions and the lay public. There are many avenues open to us for the communication that we provide to teachers and parents and so on. We use Madison Avenue techniques. We use legislative fiat. We use computer language. All the linear types of communication are open to us.

Now the communication which we have within the professional area can also use that particular type of communication. But, in addition, we can and do use a type of communication which allows us to perceive interrelationships, or reciprocal relationships in the real world. This technique is called systemic thinking. That's why I think it fits well into what we have been saying about models, or systems, or frames of reference. Actually, this techniques of communication asks the question of what should be done rather than what can be done. It helps to define a professional area because it requires certain conditions of equality and understanding. I've been reading Robert Theobold recently who refers to this type of communication as OUTER as contrasted with INTER, or more structural type of communication which is provided for others outside a given field. OUTER communication is defined by Theobold as a "a blabbermouth language written on psychic tissue paper." It's made up of partial insights which we share within a framework of a profession, all of which then add up to a type of synergism, i.e. where all the partial insights together make up more than these would be by themselves.

The conditions for OUTER communication are three: (1) it requires input of credible information, (2) it requires opportunity to discuss with people one trusts and (3) it requires opportunity to put new understanding into practice. Given those three conditions, it is possible to move into action. Action is the key to this type of communication. It's my opinion that action needs to be undertaken before boundaries are certain. The only caution, however, to remember in taking the action is that this action must be responsible action. As Theobold says, "It is immoral to act in situations which one does not have the skills to handle.

The point I want to make regarding communication as a basic process is that learning disabilities as a field has been through a great deal of both types of communication, with some of it being the OUTER type--the exchange of partial insights as these have occurred to us. Some of our communication has been responsible, but I feel much of it has been irresponsible. And that perhaps should be the question which we have to ask ourselves as we look at definable boundaries--whether we can keep our interchange and/or advertising as responsible as possible. A seminar such as this provides the conditions which Theobold stated--at least the first two; input of credible information, and discussion with people one trusts. Next, the course of action must be taken.

SENF: Are you suggesting that putting the knowledge to work has not been done entirely responsibly within this field or that some of the communication prior to putting it to work has not been responsible.

KASS: Both. Some of it has been responsible, some of it has not been. For example, I feel that we have undertaken communication toward other professions and the lay public which has been of the sort that indicates that it is the responsibility of all teachers to act on the basis of knowledge in this field. Is that clear?

HARING: Not to me it isn't.

KASS: Okay, the partial insights, the knowledges, and the approaches which have been acquired and taught in a specialty sort of way, are communicated to regular teachers and parents for action. In the process, these lose some credibility and the opportunity for sitting down together with people one trusts for refinement of the idea.

KEOGH: Corrine, what about the credibility of applying the partial insights within the field.

KASS: I think that's more responsible.

MC CARTHY: Would you put in the category of irresponsible actions the referral by the teacher to the neurologist of every child who wiggled an eyebrow, or deviated in a minimal way from her standard of normal behavior.

KASS: Yes.

MC CARTHY: This is certainly one example of an action that has permeated our field that was based on a partial insight. This type of referral or parents was probably overgeneralized in an irresponsible way not only by teachers but by psychologists who may have been the worst offenders. I'm reminded of a very interesting study that was done in Chicago at the University of Illinois Center for Handicapped Children on the numbers of children referred by school psychologists for neurological examinations. Eighty percent of them had negative findings. Now this was a select group of referrers, school psychologists who theoretically had done something prior to referring them for a neurological, an EEG, and medication. And yet their percentage of hit was much lower than their percentage of miss. Is that the kind of thing you were talking about?

KASS: Yes. Also, what many of us do far too readily is to go round the country doing two or three day in-service workshops. For example, I've talked to 500 first grade teachers who are asking how to handle the learning problems in the classroom. The question we have to ask ourselves, following such communication, is whether we have actually given these teachers skills with which to handle the situation.

HARING: Now, referring to where you are in your outline, is this an example because we've seen increasingly numbers of pediatricians referring. Parents take the child because they're having a lot of school problems. The pediatricians are starting to say, "That's hyperactivity. That's minimal brain dysfunction. That means we've got to medicate." And they bring these little children back and they're out of it. They have no experience with studying the effects of medication. Now is that an example of miscommunication because of the time lag?

KASS: Yes. It's taking something that is perfectly reasonable for one situation and for someone who understands what they're doing. But it is not necessarily generalizable across a number of children.

KEOGH: That's an intriguing idea. The problem I'm having with it is how does one know when an idea is credible, when it's responsible.

KASS: I thought about that and about the only thing you could do is to depend on face validity. In other words, as we listen to each other, what we say has to have some believability.

BRYANT: And we fit it within our frame of reference or our model.

KASS: You know you can have a salesman-type person who can sound very believable. That probably could sell a notion and action can result. We do have quacks. This can happen and it can sound extremely credible. The question always comes back to the professional person who must decide on the credibility.

HARING: This is really interesting. This is really magnified. These are otherwise competent pediatricians but they're practicing quackery. Out of the learning disability, hyperactivity kind of thing, absolutely honest honorable pediatricians are being turned into quacks.

KEOGH: On the basis of partial insights.

KASS: And the parents and regular teachers trust them.

HARING: Is that what you're talking about?

KASS: Yes. I'm just saying if we do have a field with definable boundaries, then there must be some collection of whole insights as well as partial, which we should be able to put together and communicate.

BRYANT: Another example of this is the fact that frequently we do not utilize all the research evidence, that we go on beyond a point where the research evidence has questioned things so that we become rather irresponsible. I remember, Lee, in your article with Don, I think you had about 12 research studies specifically on the Frostig-Horne where it was very clear that it was not providing transfer to the reading act. Now the research is fairly clear. But, what happens is that we still see not only it's used but professionals using this as the illustration that this helps visual discrimination, or this helps improve reading ability. Another irresponsible thing is not to utilize the information we have coming in.

KASS: Let me just round this out with a response to that and then go on. I recently read a book called the New Promethians based on this notion of responsibility in great discoveries. This book analyzes greats like Darwin and von Braun, etc. as to how these people looked at the consequences of their action on human beings. Were they doing it for economic reasons only, or for curiosity's sake? I don't know of any easy way to determine examples of responsible actions versus irresponsible because it goes back to the very sticky problem of motivation. The very same act may be responsible or irresponsible depending on the motivation.

Let me go to the next point and discuss hope as the basic emotion in the field. And I'm taking this now from the point of view in learning disabilities that normal achievement potential is possible. We have cases of children who have, through remediation, been able to achieve normally. Not only in learning disabilities, but there are the potential Helen Kellers in all deaf-blind children. The studies on intermittent reinforcement show that this is a very powerful emotion in that responses go on and on because the goal was sometimes attained. What we've done in this field with this assumption is to allow this optimism to spill over into less hopeful situations; such as mentally retarded with guarded vocational possibilities, slow learners with enough abilities to get them through life semi-adequately who are being herded in the arena of a special curriculum designed to prepare them for the mainstream where the possibilities for advancement seemingly are limitless. I think that's what we have done and I think these are instances where such an emotion is not reasonable.

HARING: That's cute. So that the effect of intermittent reinforcement is to create kind of a state of hope.

KASS: Optimism. Let's do the 1 to 1, expensive remediation which might save society some money later on, but too often it's that "might" which later proves us wrong.

MC CARTHY: I've seen more messiahs in our field than I have in almost any other field. We're going to save the kids.

KASS: Again, the motivation may be right, but there's a lot of misinterpretation of the motivation. I have lately come to feel very badly at the number of times I must tell parents and even medical people that the prognosis for this child probably is guarded in relation to college work. And I think we will find growth of interest in this field.

Third, I would like to talk about a perspective for the field. In order to maintain perspective and be sure we do have boundaries, we must recognize that the task of discovering mass solutions is overwhelming and cannot be accomplished within the boundaries of a single field. The understanding of enough knowledge and technology to combat all types of learning problems is an impossibility. As we all know, various aspects of the human being in isolation have been the lifelong study of scientists and scholars. It would be nice to have internalized enough knowledge and technology and understanding to be able to handle all the handicaps and problems across the educational system. But, we just have to face the fact sooner or later that to use a homely analogy, you can bite off and chew only a part of meal at a time. Because of this I think the trend has been to work with minor problems in response to greater numbers, rather than to study thoroughly the difficult and puzzling problems which actually in the end will serve to add to knowledge about deviations in learning.

Now with that perspective in mind, I think we have some positive elements and some negative elements. The positive elements are that we have shown both sides of the coin in much of what we do. First, in our training programs, we have actually combined both diagnostic and remediation skills in one person. It is less expensive to handle one child if you can use one staff person who can do both the analysis and remediation.

Second, in this field we have been able to combine both task analysis and analysis of functioning within the organism. We may teach these skills to a greater or lesser degree of competence, but we do find this combination.

Third, in this field we have combined clinical goals for curriculum planning with broad educational goals. As an example in learning disabilities, a specific clinical goal is to do something about a deficit. At the same time, we want to recognize that there are individual differences and a range of individual differences can be tolerated. This is the broad educational goal. It is possible to take paradoxical goals, study the relationships, and show that, in fact, these are not contradictory.

Fourth, we have combined principles of remediation with developmental educational principles. These two sets of principles are different or opposing in my view. We have been able to distinguish the principles which would be necessary when we're dealing with developmental education and those which would be necessary when we're dealing with remedial education.

HARING: How do you see them as being paradoxical or did you say opposing?

KASS: Opposing. In remediation, the most important factor is the age factor. The factors of chronological age and language and speech development all feed into the remediation that must be applied. A child of ten must be treated differently in remediation even though he acts like a child of five in some aspect of development.

MC CARTHY: May I ask one question. You're not suggesting that the skill sequence would be any different in a child of ten than in a child of five.

KASS: I'm saying the principles of remediation would be different.

MC CARTHY: But the content and the methods.

KASS: The content might not be different, but the treatment would be. Let's say we've got a ten-year-old fourth grader. You might start in remediation with the fourth grade text books or with task analysis. You have to start with what he's supposed to do rather than a readiness worksheet which doesn't really tell you about what he's supposed to do at age ten. In remediation, we work backwards and then forward. Remediation involves double the steps which are followed in development learning.

That's my partial insight at the moment. I'll say that's a partial insight because it would require a whole book to develop the entire argument.

There are also some negative elements, I believe, in looking at a perspective of this field. First, the extreme focus on sensory perceptual processes has been overly emphasized. So little is actually known about the workings of the sensory channels in relation to learning disabilities and I'm afraid teachers have picked up these terms--visual perception, visual-motor problems--just as if they really know what these mean. We do know there's lots of physiological work, biological work regarding the actual functioning of these channels which is ongoing. However, we have allowed that emphasis to permeate. In my view, it takes nothing but raw courage to say that I am changing visual perception by what I'm doing in either content or treatment in learning disabilities.

HARING: In other words, we've done to our own field a certain injustice in parallel with that which we've done to the pediatrician. We've made our own teachers quacks.

KASS: Yes. Recently, I heard a psychologist, who has worked in visual perception for approximately 20 to 30 years, make this very startling statement: "If man were born only with the sense of sight, he would never learn to see."

SENF: That tells me we know an awful lot about sensory systems. And I'm amazed at the amount of knowledge that has been amassed in the last 20 years, I think we within this field haven't been able to utilize what we know about sensory development.

KASS: I grant you that statement.

SENF: Though maybe a large part of the problem is that we don't have a way to instrument the kind of things we have learned about.

KASS: I agree and perhaps I should modify my statement by saying that there is knowledge we could learn. However, in many research projects on learning disabilities, the tasks are too simple for the age level at which they are applied. Most of the tasks have to do with geometric figures of one sort or another. Typically we consider these to be at the readiness level. Readiness is a difficult concept also, and it may be a bit premature to say that this much auditory needs to go into readiness activities and this much visual.

Another negative element in our perspective is that materials which may have originally been developed for deficits have evolved into developmental materials, probably for economic reasons. For example, the Peabody Language Kit, the Frostig Program, Kephart, etc. were designed for problems at the beginning. But, through the process of making these marketable, they have become good developmental programs, while losing some of the freshness or usability for remedial work. Publishing companies have been flooding the market with materials which are said to be necessary for educational improvements in learning disabilities. We prepared an index of 50 publishing companies for our LTI report this year. The catalogs are filled with headings such as visual perception, visual-motor perception, kinesthetic, tactile, and on and on. Our profession has allowed this to happen; it's allowed the market to be thoroughly flooded with bright colorful expensive materials.

A third negative element is that in this field we've allowed the label to become a wastebasket term for getting money. Notice, I didn't say a wastebasket term for placing children into the service--a wastebasket term for getting money, not only for educational purposes but for research purposes as well. Even in research, this label has been attached to a proposal for the purpose of getting money. There's been a high interest value in this term for economic reasons. The high interest value has not necessarily had philosophical underpinnings. It's been a prestige label, but at the same time it's aroused fear because of lack of understanding. It's a nebulous construct which has not been the purview of any professional field. Certainly education does not have a premium on learning disabilities. It's become popularized and has become a wierd combination of mystery and universalty.

Now the fourth point I'd like to make concerns the relationship of all of this to prognosis for the children and I guess trying it to the moral implications. Basic to all we do is kind of a prediction or a look into the future of what will actually happen. How much money will we save society; is it good to spend the money, the time, and the training, as well as the research on a 1-to-1 approach? It's a question of how far this goes across the educational system. I think what we will find, if we look at prognosis as a concept, that we have to use our professional knowledge and technology in order to project into the future. And sometimes we have to make a guess about whether a given child can go to college or needs to be steered toward vocational training. Then, of course, we must be willing to check this out in reality. In order to judge the responsibility of our actions and our communication, we have to look at what has happened longitudinally, and we must project and make some guesses.

SENF: I'd like to comment on the general issue of funding that you raise. From a research point of view, I think that it certainly is the case that people are getting interested in reading research because our President has made us believe there was going to be money to support it. I don't think you can expect people to be independent of the reward structure and also I don't think it's really appropriate to expect a good researcher to go unfunded because their area or approach is presently out of favor or not in vogue. Sometimes one can shift his interests enough to respond to where the money is. And this is your point as I see it Corrine; who is deciding where that money goes? It is the issue Barbara raised as to what kind of integrity a field should have to influence its own direction through control over funding.

KEOGH: I'd like to expand on that in a somewhat different way, combining Corrine's very excellent point on responsibility-irresponsibility and my own concern with a lack of professional leadership. I think this is reflected in journal publications in this field. I am shocked at the level of work of my colleagues on review panels of many professional journals dealing with exceptional children. I think it is really a scarey kind of thing that certain articles get into the official house publications of major professional organizations.

If a teacher in Hastings, Nebraska reads an article in a professional journal, she has every right to believe it, and she well may believe it and utilize it. Yet, there are irresponsible things that appear in journals in almost every issue. I consider that the responsibility or lack of responsibility of the editorial reviewers. Secondly, I would apply the same thing to federal funding panels of which all of us have been readers. There are inadequately designed and conceptualized projects funded every year, partly because of unwillingness of panel members or review people to stand up and say this is a poor design, it should not be funded now or ever in this present form.

BRYANT: Even if they say this, that doesn't necessarily mean that it won't be funded as there are other decisions such as yes but this state has special circumstances.

KEOGH: Yes, I understand that. I realize there are many political considerations, but I put review of federal funding in a similar kind of category as the review process for professional publications. I think it illustrates beautifully your point on irresponsibility and I choose to interpret that it supports my point as to the need of competent professional leadership. I think that's the direction we have to go.

I'm not really proposing another professional group. However, I feel the need to communicate with people who have similar concerns and interests. We don't have a place for dissemination of research findings specific to learning disabilities. For me, that's a high priority area. More importantly, I don't care whether the journals have applied or research emphases, there is need for more quality publications. When we talk about dissemination, I think the responsibility-irresponsibility issue becomes a critical one.

STROTHER: We've just got two presentations left, Jeanne and Doris. So, we can take one now and one this afternoon and then spend a little time this afternoon trying to structure things for tomorrow. Would you go ahead, Doris?

INPUT LECTURE BY DORIS JOHNSON

JOHNSON: I would like to begin my comments with a thank you for the invitation to participate in this conference. I'm a little bit jealous for our own students seeing the University of Arizona students sitting here. Nevertheless, I will certainly try to give our students feedback from this conference. I also would like to commend Dr. Strother for his opening, thought-provoking questions.

The issue of definition continues to pervade this field and I agree with the others who spoke earlier, that we need operational definitions. The labels we have used in the past have not facilitated education nor have they been particularly useful in designing educational programs. Consider an analogy from cerebral palsy rather than learning disabilities for a moment. As a former speech therapist, I was very interested in the cerebral palsied child; however, while working with the children, it was evident that treatment of the motor condition was not sufficient. Furthermore, the label cerebral palsy did not really tell us what was needed educationally. Eventually, there were efforts made to sub-classify the population into groups such as the spastics, athetoids and ataxics. These sub-groups required different techniques but they still did not fully describe the psycho-educational problems of the children. It still left us with a restricted view of the cerebral palsied child's needs. We have similar circumstances now with learning disabled children.

I believe our task is to try to tease out the universals that should be studied in all exceptional children. As we attempt to integrate the findings from psycholinguistics, child development, child neurology, and learning, hopefully some of the universals will emerge. Rather than looking at test profiles or strengths and weaknesses, I think our question should be, "What are the behaviors that should be investigated when assessing children?"

It seems to me that there are two large classes of behaviors that should be investigated. First, there are all of the intraorganismic factors--that is the learning characteristics of the child himself. The investigation would focus on the analysis of entire sensory systems, that is on the learning through the auditory system, the visual system, the haptic, and so on. Then the investigation would proceed to intersensory and integrative functions. Finally modes of output such as the auditory-motor system for speaking or the visual-motor system for writing would be investigated. Then we need to look at the interrelationships of these patterns in order to study the effect of disturbances on higher areas of learning.

The second large class of behaviors pertains to child-environment interaction. We have been somewhat remiss in our studies of the effects of a handicapped child on the people in the environment. Moreover, we have not studied the reciprocal effect of parents, siblings, and peers on the learning disabled child. The behaviorists have added a good deal of information concerning the nature of the reinforcers, but I think it is time for us to synthesize information from various branches of the field. We need to expand our vision and perspective to study the child in various environments--at home, at school, and in the community. Unless we take a broader view, we might well earn the label of "perceptually handicapped teachers"--that is educators who view only the parts and not the whole. It is also important for us to realize that a definition will either expand or restrict one's vision. Therefore, we need definitions that will broaden our perspectives of children.

I think we also have to learn to live with the fact that there are great bodies of knowledge yet to be acquired, and at the same time, be willing to take a few risks. I am reminded of the preface to McNeil's book on the Acquisition of Language. He said, "Writing a book on the acquisition of language is somewhat like the problem of reconstructing a dinosaur while the bones are still being excavated. It can happen that after you've connected what you earnestly believe are the hind legs, you find they are the jawbones". He says that revisions in thinking may cause us to realize that the bones don't even make a dinosaur, but that they make a whale instead. This should not cause us to stop digging. We have to realize that we are still in the middle of the digging and that the evolution of definitions and categories is still taking place.

As we set up categories and operational definitions we need to help others in the field see these in relation to a child's learning and progress. For example, terms such as aphasia or dyslexia may be used at one time in a child's life, but as he progresses, new terms or new operational definitions may be necessary. A child may begin as a preschooler with the diagnosis of a receptive language disorder; however, as he improves, he may no longer have difficulty with the spoken word but may have problems in reading or writing. Thus, we need fluid terms rather than stagnant or stable ones. One looks at descriptions of behavior based on the child's previous experience and on expectancy.

Next, I think we might consider some of the types of research that we need in regard to remediation. Some of our approaches have been much too simplistic. That is, the child is given a series of tests, and after a period of instruction he is given the same battery of tests to determine whether he made progress. Again, I think we need a broader focus. We should look at changes, not only in academic achievement, but the total facilitation of learning through impaired modalities, at changes in social maturity, ego strength and participation in groups.

I have another "pet" topic concerning future research. It pertains to the delay versus disability question which was posed earlier in our discussion. It seems to me that this is a very crucial issue with regard to remediation. Currently we are engaged in several longitudinal studies in language development to determine whether children with language disorders follow a pattern of delay or difference--that is whether they develop language similar to the normal child at a slower rate or whether they show idiosyncratic patterns. Paul Menyuk, from M.I.T., found that children with infantile speech patterns were not just delayed but different. We are now seeing similar patterns. As you know, Laura Lee from Northwestern has developed a model for scoring developmental sentence types in young children. The researcher gathers a broad language sample from a child and scores the phrases or sentences according to norms. We have been finding that youngsters with specific language disorders show some unusual patterns. For example, they use few designators; they have particular difficulty with negation and question forms. This empirical evidence suggests that a developmental approach is useful for comparing language of various children; however, the fact that the patterns are different suggest we cannot merely "wait and see", nor follow a specific developmental approach in remediation. Rather, we must explore which syntactic, semantic or phonological rules the child has not acquired and attempt to facilitate the learning of these specifics.

I could choose other examples to illustrate the delay versus difference concept. You have all seen "draw-a-man" pictures by learning disabled children that were not characteristic of younger children. Some have no structures or boundaries; some have distorted body parts; some have inverted or rotated parts. The organization is different. There are also many idiosyncratic thinking disorders that Strauss and Lehtinen described very well many years ago.

Recently we had an opportunity to discuss these issues with researchers in child development, particularly researchers from the Piaget school of thought. We asked them whether they thought the Piaget nursery school approach might be appropriate for our youngsters. They had no strong opinions, but indicated that they never tried to "push" a child in one area of learning over another Rather, they assumed that all parts of the organism were functioning harmoniously and that the child would learn when he was ready. Personally, I think we will need to modify the educational program so that weak areas of learning may be facilitated.

It might be well for us to look at Bruner's work. He suggests that theories of learning are not the same as theories of instruction. I think many linguists would agree. A theory of language, is not necessarily applicable to the instructional phases of language. Hence, we may need not only theories of learning disabilities but ~~theories~~ pertaining to the instruction. Many of us have opinions or philosophies of remediation, but we definitely need comparative research. For example, we need to compare the "end result" of approaches which focus on processes such as perception or memory versus those which focus directly on academic achievement. These in turn may be studied against those that focus on perceptual-motor training or personal-social behavior. While engaging in research of this type one also must look at the educator's philosophy of man. We tend to teach those things that we feel are important for the future adult in society. While some may feel academics are of prime importance, others feel interpersonal relations are of greatest significance. This means that the special educator should really state his philosophy and his priorities for education.

There is another approach that we have not investigated well enough in special education. I would like to see more studies done on communities in which there is a low incidence of underachievement. All too often we concentrate on those areas of high underachievement. We might well learn more about potential for change by studying those factors which contribute to low underachievement. Questions such as the type of instruction, administration, staff interaction, goals, etc. would be relevant.

Obviously we also need longitudinal studies. These may help us in predicting which types of disorders will need the greatest amount of special education. And they may also help us see how our educational programs should be modified. Currently we have a group of young adults in remediation who have been through our schools. I have interviewed a number of them and they have some very strong opinions about what they were and were not taught. Feedback from older learning disabled students is critical. Their suggestions might provide us with alternative plans for education. For example, one high school student who was failing while taking four solids, was permitted to go through high school in five years and take a reduced load. This allowed time for remediation as well as opportunities for extra-curricular activities. Had he tried to continue with the four solids he would have had a grade average of D. As it was, he maintained a B to a C average and eventually went in to college.

I feel we desperately need different kinds of approaches at the junior, secondary and even college levels. Many of the students resist the remedial work because they want help in school subject matter. Perhaps we can adjust the time line as well as the structure for these students. In addition, we might consider some continuing education for young adults. Their vocational options are definitely limited by their inability to read and write. Our community education, and even that in the schools should not focus solely on academics. Our longitudinal studies indicate that the personal-social issues are as great as the achievement. It is not very pleasant to hear a mother say, "My son is economically independent, but not socially". We have not really done our job unless we have looked at the whole person. Recently a local hospital learning clinic inaugurated a social group for teen-agers with learning disabilities. They were concerned, as we are, about the "loner" who has no friends. He tries to enter a group, gets rebuffed, but does not know why. Many of them need to be taught how to function in a group, and I believe this is a part of our responsibility. This means that we must look at broader parameters than those on psychological test profiles.

There is a great need for work on curricular planning in self-contained classes in learning disabilities. In most communities, teachers decide to teach whatever they want. Some focus on test behaviors; others teach the regular curriculum but at a slower pace. I would hope that in the future we might have some conferences devoted to curriculum development for learning disability classes.

Finally, I will add a few points on teacher education. We have a vast area for study on this topic. In reality we should be as careful in teaching our teachers as we are the children. Probably we should begin with a study of their entering behaviors--that is, their educational backgrounds, experience, and knowledge of their style of learning. This should be followed by differential teacher training whenever possible. That is, we should see which student needs or learns best by modeling, which one can apply verbal principles, which one can explore new styles of instruction. Ideally, we would like to have the staff and facilities to teach each student according to his style of learning. This might include a library of videotapes with various types of instruction, clinical teachers to demonstrate and to provide the student with immediate feedback. We might even try a contract system with the students. If they want and need a great deal of modeling, perhaps the university clinics may not be the best place for the training. Rather, more opportunities for work in the community and schools should be provided. If this latter plan is adopted, we might appoint outstanding supervisors or master teachers as clinical professors to give them the recognition that they deserve.

I also believe that teachers can be involved in some types of research. Many of them have excellent ideas about remediation but do not have the techniques or time to start research projects. Collaborative research between the universities and schools could ultimately add to the body of knowledge in the field. Even without these projects, however, I think we can stimulate teachers to think systematically and they might be able to start some simple projects on their own. With even preliminary data, they might then contact service organizations or other groups to support research. Teachers should feel that they can be contributors to the field and not just readers. Many of them could be encouraged to submit articles to journals.

There is one last area for research that has not been mentioned; it pertains to genetics. At the moment we have at least ten families with two or more children who have learning disabilities. I know there has been work on genetic dyslexia, but little or none on auditory disorders. Yet we see what appears to be hereditary language disability very often. While one might begin to look at genetic counseling in some instances, the greater issue concerns the siblings and the need for looking at high risk children as early as possible.

STROTHER: One thing you said, Doris, intrigues me very much. It's not the most important thing you said but it makes me look at something a little differently than I did before. When you talk about taking let's say a seven or eight year old child and looking at his performance on a draw-a-man test or his performance in sentence production and you find that this is not really an immature performance but that it's qualitatively different than the performance of other children. When you think of it, if you lose the function of some muscles in the leg, other muscles hypertrophy and your whole muscular system in ambulation functions differently than it did before. So maybe, if there is a functional deficiency early, we see a different kind of development in the rest of the cognitive system, if you want to think cognitively, that has implications for diagnosis and therapy that hadn't really struck me before.

JOHNSON: I would like to devote my next decade of research to that very area. I think there are probably children in LD programs that are delayed, where with more instruction they'll progress. But, I do believe there are many where the patterns are different, but we don't have enough evidence to show that yet.

STROTHER: That's exciting in another way when you think for example of studies with Guilford's structure of intellect model, the fact that this model is replicated across a wide age range. The studies of children between two and five years of age show the same essential structure that the adolescent and the adult does. If there is a uniformity of structure developmentally in the normal case and now you have an abnormal case, what are the ways in which this total structure then changes with age as a function of that early difference.

JOHNSON: And it goes through every area of development that we're studying; if you take language such as dimensions of phonology, semantics, and syntax there are vast areas for study. Eisenson has hypothesized that the rule learning behavior of the "aphasic" child is different. Eisenson is suggesting that some of the children have phoneme categories that are too broad and some that are too narrow. So that in that "s" category, he may place "s", "th", and "f" altogether. The category may be too narrow so that the "s" in "bus" and "list" are in fact different which means the child has to store too many bits of information.

STROTHER: Well, I wonder if this is in a way the same idea that Norrie was getting at in talking about the difference between a deficit and a disability.

JOHNSON: That's exactly right. And I think the probe technique that he was suggesting could be very useful. As we gather data, we must not forget to obtain information from the environment as well as from the child. In the Brown and Bellugi (studies in linguistics) it took one mother ten hours to use all the plurals, whereas it took another mother 44 hours. The first was using a specific kind of game with her children. This means we need to have the data from both the child and the environment.

KASS: And this also dictates different principles of remediation and that's what I was referring to.

CHALFANT: I'd like to follow up again on your comment going back to the difference between disability and deficit and what I call a process dysfunction. If, in discriminating between a learning disability and a deficit, I suspect that a particular process is not functioning properly, I would expect that any other task which made a similar demand on that same process would also be a failed task. I think if it's an auditory processing problem with task A and I go to task B which also makes the same kind of demand and the child passes it and he also passes C, D, E, and F which also make demands of that process, we probably have some kind of situational or learned problem, and not a process deficit at all. If I get across the board failure on a process then I think there may be a process dysfunction operating.

STROTHER: Norrie has a comment to make, but before you do Norrie, let me just say one thing in response to what Jim has said. This is of course one of the critical tests of the efficiency of a cognitive model. Given an observation of a difficulty on one task, can you predict difficulty on a dissimilar task with different content but presumably with the same process involved. If you can, you've demonstrated. . . Go ahead, Norrie.

HARING: I wanted to make a comment about the way in which Doris's comments strengthened the idea that Corrine had with respect to the inconsistencies of development and remediation because I agree with you but I was pressing and I think maybe unfairly to have you. . . Maybe I disagree with the idea that you necessarily have to follow the same principle in remediation that you do in development. And I thought Doris gave some kind of good additional thinking to this by the fact that in talking about a deviation, we were talking about the biological studies, the pathology. This may be a different process than normal development.

KASS: Take your charts that you showed. You showed some children where your five sessions didn't do it and you said something else is needed. Those were the ones in my view that would require principles of remediation rather than the developmental principles.

JOHNSON: I agree. Consider a simple example from intra and intrasensory learning, I don't think intra necessarily precedes inter nor that the organization for every child will be the same even among the normals. It was fascinating to watch several five year olds on the temporal-spatial learning. Some could learn the rhythm if they had the dot pattern in front of them. Others used rhythmic, bouncing head movements, other counted. The mediation is fascinating to watch; but all we could do was tabulate and record our observations. The way in which the organism is functioning is based not only on deficits or integrities, but the relationships between the two.

SENF: I'd like to amplify that. It really says you have to have some notion about how the various processes are tied together. Until you are able and willing to write down on paper these hypothesized relationships, you realize you haven't really thought it out carefully enough. As I said earlier, this field desparately needs testable assertions about the interrelationships between the type of processes you describe.

HARING: I think the real higher level cognitive approach to learning problems could give us important information. But here is where you use information and testing concepts about what should be to help fill in what actually the response as a summation will verify. So that it is fruitful for us to continue to work with cues which will help cue responses which verify the response being a summation of a process that you speculated would occur on the basis of the cognitive approach, the cognitive concept you used. And that makes sense. If we continue to drill in an area without any systematic way of locating our target, we could spend money all over the place. We've got to have better ways of locating our targets.

KEOGH: I have a specific question that relates to that. It really is directed toward Doris. I was intrigued by your statement that Eisenson had noted that some children had too narrow categories or too broad categories. In some of the work we've been doing on cognitive and perceptual styles we have considered Gardner's construct of equivalence range. My question is, do the children you described have the same kind of categorical or equivalence range problem in other areas of performance besides speech?

JOHNSON: I think so. I think they acquire rules, but they are different from the normal.

STROTHER: I think one thing Barbara was asking here was what would these children do in an object sorting task?

JOHNSON: I think we'd have to do more research on every area of behavior but that is what we're looking at. For example on a word association test done at Minnesota on normal children, some of ours gave quite idiosyncratic responses. In response to the word "desk", instead of table, chair, or anything else, one child said "Chicago". Why "Chicago"? His father's desk is in Chicago.

KEOGH: It would be interesting if one took the construct "equivalence range" and applied it sort of in a clinical sense to the observations of the children's speech patterns or linguistic patterns. And there is a prediction there which is testable and would be very interesting.

SENF: You mention at least what are to me two quite different and very good new ideas. One of them is community education for young adults and the other is involving teachers in the research process. I see one of them, the first spreading as expanding us even thinner so I'm not enthusiastic about it. I see the other, involving teachers in the research enterprise, as shoring us up to some extent and providing us new data. Do you make that distinction?

JOHNSON: Priorities. If I were to place the priority, I'd gather more data first. Though I think some young adult groups could provide us with data about the nature of their problems which then could feed back into the educational programs.

SENF: And each time a new topic is introduced we have to have more people to provide the basic data.

JOHNSON: But could we not take youth workers, counselors, and give them some training in LD too.

SENF: You've already got your next ten years filled.

JOHNSON: True! We really do have priority issues--particularly in regard to research and education. You read Cruickshank, he continues to say we should focus less on children and spend the next few years on teacher preparation. I talked about this both with physicians and with people in education. They said if we use our teacher educators or teachers correctly they can add to the body of knowledge without waiting for those two years.

HARING: That's a very important point.

SENF: Not only important but a lot of the people who are trained to do these application tasks can't just turn around and do research. People have specific skills.

JOHNSON: May I also respond on a cost basis? I think we are going to waste a tremendous amount of money by stopping the education at the junior and senior high level. All the money that goes into the elementary ed. may be wasted as you watch the students start to fall apart at junior and senior high. I think we need to make people aware of the fact that early identification is not synonymous with prevention. We're going to have to be prepared to deal with children all the way through school if, in fact, there are central nervous system processing disorders. You don't expect education for the deaf to stop at eighth grade, rather you provide the services as long as they need. We will need the same for learning disabled children, including vocational efforts.

CHALFANT: The cognitive research in child development shows all curves flatten out as children move into adolescence. Although there are not great quantitative changes in the cognitive abilities, it's primarily a qualitative change that occurs during the junior-senior high period. If we pull the rug out from under our students after we carry them that far, when they move into this qualitative change period in terms of process, we are going to have problems.

MC CARTHY: I became intrigued by this whole thing of cognitive style and especially with cognitive style mapping. At Oakland Community College outside Pontiac, Michigan they have had a project ongoing for four or five or six years, at least, where every incoming freshman goes through a battery of tests which are then computerized and a printout is produced of the student's "cognitive style map". The purpose is to match the cognitive style of the student with the cognitive style of the professor so that they've done this cognitive style mapping on all of the instructors also. One of the specific pieces of data derived from the computerized cognitive style map is what English section the student should be assigned to. Do they need modelling behavior, do they need lots of auditory input and tapes and so forth or do they need individualized or small group instruction?

INPUT LECTURE BY JEANNE MC CARTHY

I'd like to abstract a portion of my formal presentation at this point since it's immediately responsive to the discussion and pushes this point a little bit further. It seems to me that the problem is much more complex than just discriminating between a deficit and a disability. As mentioned very briefly yesterday morning, we see too many children who may have had at birth or at day one, a minimal deficit due perhaps to genetic variations in processing mechanisms or to delayed maturation of the central nervous system, or to whatever we want to hypothesize as primary etiological factors. This minimal deficit then may have led to an avoidance of function in that area, which then led to a personality pattern or a self-perception of a person who does not function well in that area, which then was reinforced and became a habit. The end result of this complex interaction may be a severe disability. For example, if a child comes from a non-verbal family, in which no one in the family really expresses himself very well, he may avoid the use of verbal function, i.e., he doesn't talk very much. Then he begins to perceive himself as a child who doesn't talk very much and his mother and other significant adults then begins to categorize him as very "shy" child. This reinforces the personality pattern or the self-perception of what we call shyness. As the child continues to be reinforced in his avoidance behavior, the habit becomes even more entrenched. He doesn't practice speech or language behaviors, in fact he practices the avoidance behavior. Thus, by the time he gets to kindergarten, we may see what looks like a severe disability in the expressive language function. However, it may be the result, not of a severe disability that existed back there at day one, but of a minimal deficit compounded by the lack of rehearsal or practice plus the personality pattern and the habit formation that emerges from that.

BRYANT: That wouldn't even require a minimal deficit. What you described of a family that doesn't talk very much would be sufficient as such.

MC CARTHY: If I had to conceptualize it for verbal learners, I'd like to make a circle and start with a deficit here and an arrow leading to avoidance behaviors that then lead to self-perception or personality patterns that lead to and are reinforced by habit formation and then to the disability. Then the problem is where do you intervene?

KEOGH: Do you need to start with the assumption of deficit at all? Might this be true of children just in terms of family interaction and so forth as I just wonder if that's a necessary part of it.

CHALFANT: In assessing a child like this in terms of psychological process, if there's no process dysfunction I really wouldn't find one.

MC CARTHY: Well, Jim, I don't know, especially when I look at the data that led me to this realization that we've got a pretty complex interaction here in what we call an expressive language deficit. Every year we do a full testing using the I.T.P.A. and other tests on our developmental first grade children. These are children who've been screened at the end of kindergarten as being not ready to succeed with a phonetic program of reading in first grade. As a group, those children are extremely low in the auditory-vocal channel across the I.T.P.A., the Wepman, the WPPSI, etc.

CHALFANT: On a language task.

MC CARTHY: Especially in verbal expression.

CHALFANT: When I test the process, I don't use that task.

MC CARTHY: We find children at age six who score at the two and a half year level on the I.T.P.A., on the verbal expression test. At the end of the developmental first grade year, they may have gone up to eight years. I am reasonably certainty that we have not "cured" an expressive language disability in eight months between pretesting and posttesting but I do think we may have intervened in that child's habitual way of interacting with his environment. His mother may no longer say, "gee, that's funny, he's not shy anymore, he talks." People in his environment perceive him differently. He perceives himself differently. When we're measuring, we're not just looking at the quantitative score but at the whole life style, whether pretesting or the posttesting. Behavioral confirmation or disconfirmation is more important than formal test data generated in an artificial situation.

CHALFANT: If it isn't a language task and there was a learning disability, I would expect that other kinds of tasks making demands on the processes would be down.

SENF: Can I draw a very simple diagram which I think will clarify this point? What I'm representing here are two points in time. There's one point in time on top and the second point in time below. You take a child who's getting equal amounts of input from two different channels, an auditory channel and a visual channel. Imagine that there's transfer at some point in the information-processing system whereby data from basic sensory analyzers projecting onto an informational array must produce some further neural activity that we know as meaning. Let's say at this point in time for this given child, this translation between what is the auditory sensory data here on the informational array readily stimulates meaning. But for some reason visual sensory information does not have that ability for him. It simply does not stimulate what I term his imaginal system. So at a second point in time, he finds himself going more and more to his strength. In short, we have a very simple feedback system where people themselves court their own strengths and avoid their own weaknesses because, after all, they're interested in understanding the outer world and so they're interested in gathering meaningful data. So the very simple assumption that people will try to gain information about what's out there, implies that they will utilize their basic processing strengths and not waste processing time on their own weakness. What a model like this suggests is that by the time you see a child of six or seven, he's already moved way away from the careful treatment of visual data necessary for many school tasks. Note also that there's nothing in this model that posits a defect but simply an early imbalance in processing ease sufficient enough for the child to seek data from one source rather than another. This point is elaborated in the theoretical paper I have written for inclusion in the LTI's first year report.

STROTHER: It seems to me that you're saying in Sam's terms that you conceive the significant difference, and I'm avoiding deficiency, to be a channel difference.

SENF: And once that starts, it begins to feed back. . .

KASS: It's not necessarily a deficiency, it's just not being aware of the input from one.

SENF: And we simply don't know on the physiological level whether this increasing disuse of sensory data for five or so years may actually set the analyzing mechanisms in such a way that alternative processing styles are impossible for all pratical purposes.

STROTHER: Now I'm going to be an autocratic chairman. Jeanne has the floor. No more questions.

MC CARTHY: In the field of learning disabilities at the present time, I share with everyone the anxiety of responding to the pressures that are confronting us on many fronts. These pressures are coming at us from all sides, legislative pressures, parental pressures, administrative pressures, medical pressures, educational pressures. For this reason I want to start out by saying that we're all faced with some very stark realities that we need to be acutely aware of. The most important aspect of reality suggests that none of us regardless of our professional orientations know precisely what it is that we're dealing with. I feel that is especially important to say in my presentation, or my "view from the bridge," with the bridge being the public school arena in which I function. We have too many "instant experts" in the public schools, as elsewhere. That I think it is important for me to say to everyone else functioning in the public schools, "none of us know what we're dealing with and neither do you, whoever the you is."

In the field of learning disabilities, we are all grouping together against a conglomerate elusive disability for which few generalizations can be made. Therefore, rather than taking a stand which imples omniscience in a field where exploration in all the basic sciences as well as the applied fields is just beginning, I shall attempt to delineate the status of the art as it currently exists in the public schools. The state of the art in the public schools may be quite different from the state of the art in the universities, or elsewhere.

As I detect differences among us at this meeting, and I'm impressed more with the similarities than with the differences, but as I do see differences, I think they may derive from the arena in which we function. In learning disabilities, I think we have at least three levels of professional functioning. We have a level at which researchers can function, with needs that are quite different from the needs of the practitioner. For example, we've all discussed the need to categorize for research purposes so that we can then delineate characteristics and then generalize to a larger population. The needs of people doing research in learning disabilities are quite different from the needs of the people at the public school level. We have another level of practice which is the clinical level in which the problem can be approached from a variety of points of view, which differ from those of the researcher or the public school practitioner. All of these levels have justification, unique purposes and unique needs.

At the level of practice at the public school level, we have an entirely different ball game because we can not select our population with quite the freedom that you can select it if you're doing research projects or if you're functioning in a university clinic. It has its advantages as well as its disadvantages but it does mean that we are responsible to and for all comers.

As I look then, at the ball game from the point of view of the public schools, I would like to try to cover a great many areas in which I think something needs to be said. I had originally thought my presentation would cover theoretical formulation, definition, terminology, prevalence, etiology, characteristics and patterns, diagnosis, remediation, programming, interprofessional involvement, concerns, and long range planning. That's the ball game as far as I'm concerned. However, I've decided instead to limit myself to some comments on definition which does get me a little bit into characteristics but not too much, and then some comments on terminology, and perhaps on etiology although I sort of said what I wanted to say on that, and then perhaps into the theoretical formulation.

As I look at and continuously try to define our population to wrestle with the definition we're all wrestling with, I have concluded that any definition that would be useful and operational in the public schools would need to include two concepts. First, the discrepancy concept and second, the intact concept. In other words, it seems imperative to delineate a discrete group of children with severe learning disabilities. The problems involved in formulating a definition of learning disabilities which is acceptable to all those concerned with these children appear to stem from the pressure to include all children with problems in learning in this category. The population thus defined would then necessarily be an amorphous group about which few generalizations can be made.

At this point in time I think two solutions seem to be viable. One, when a categorical approach is demanded, and the other when we have some options, one of which might be a noncategorical approach. When a categorical approach is required, i.e. for state or federal legislative purposes and for financial purposes and all the business end of it, I can see the category of children with learning disabilities being broken into three components.

The first would be those children whose learning styles vary so markedly from the norm of their group as to require very specialized teaching methods.

In other words, your "real LD kid". These children are findable in a public school population. They are teachable in a public school poogram. They do need the maximum in the individualization of instruction.

The second group would be those children whose learning styles require a teaching approach which differs from the curriculum of the regular class but who can learn in the regular class with expert teaching, with curricular modification and curricular flexibility. This is the group that is the hardest to wrestle with, within the learning disabilities frame of reference. They might have problems in one class and not another. As the reading program changes, they may no longer need special teaching. In Schamburg when our basal reading program was Scott Foresman, we had a particular kind of child that we referred by the teacher as differing so markedly in learning style as to be beyond her competence level. Generally speaking those kids had visual processing problems. Then, when we switched to Open Court which is heavily phonetic program, our population of LD kids shifted dramatically so that I would say 88% of our LD kids shifted from visual problems to auditory problems. There's a hardcore that hung in there and that's that first group I spoke of above. However, the characteristics of the majority of the children changed. Our group graphs on the developmental first grade, the kids that are of concern to their kindergarten teachers, just reversed.

HARING: In terms of where you are in learning styles, this is refined as close as you've been able to define the groups.

MC CARTHY: I think I'll get it a little bit narrower. I can see the "real LD kids", the victims of the curriculum or of teacher incompetence, with apparently less severe disabilities initially, and then the multiply handicapped. We have to face all of these in the schools, since we don't have the privilege of saying "I'm not going to address myself to the second category or the third category." We'd all be out of jobs in the public school if we did that.

BRYANT: Is your third category, when you talk about the child with a learning problem, is the learning problem of type one where the teaching required is very special?

MC CARTHY: Yes. A severe learning disability in addition to mental retardation or what not. Thus, a discrete category of learning disabilities would be specified. I insist on this in my own district because I think those children do exist and do have priority in our program. I don't think we have the privilege of excluding those children who become learning disabled because of teacher incompetence or curricular inflexibility or those whose learning disabilities do not exist in isolation. For example, we have itinerant LD teachers who cannot justify walking by the MR class with their nose in the air as if they have nothing to say to the MR teacher. Those children need the same kind of help and that MR teacher needs the same kind of help that all the other teachers in the school also need.

Now within the first group of children with severe learning disabilities, we can then define two variations. One, for lack of a better term, we can call the primary LD's which would be due to unknown causes, i.e., idiopathic or cryptogenic learning disabilities if you like fancier terminology. Those children in whom there is no substantiated or substantiatable organic or environmental base. We look at them and we don't know why they are not learning, but they are not.

Then, there's a second group within that first group of severe LD kids that could be called secondary learning disabilities. They're due to substantiated causes, such things as temporal lobe dysrhythmias, localized brain lesions, genetic patterns, emotional trauma, environmental underload, etc. We can pinpoint a cause but I don't think we need to think we can then exclude them from the LD population because we know what happened or what caused it. In general we don't know what causes the problem with most of the children and for another large group we're probably guessing albeit they're educated guesses but that's about all.

JOHNSON: Are you content to use the term learning disability for one, two and three?

MC CARTHY: No. For the type three child, I would say "learning disability associated with mental retardation;" etc.

JOHNSON: When the learning style is the hardcore LD versus other types, would you differentiate a learning disability versus a learning difference?

CHALFANT: If the learning disability people have something tangible to offer in the way of a treatment method, then does it really make any difference at all whether we know what the cause is or if the child's mentally retarded or walks on his hands as long as he needs that kind of treatment? If a retarded child can benefit from a learning disability class, put him in that class.

MC CARTHY: I share this feeling, but I am then concerned with this age span of the class, with very bright LD children, mixed with older MR children. What I want to say specifically here is that if the child is not learning, he does need to be included in the LD program in the public school even though he may not be the nice discrete learning disabled child that in a clinic or in a research project you might be able to focus on. We have a fuzzier population in the public schools, and need to broaden the parameter within which service is provided.

CHALFANT: If he can benefit from what's going on.

KASS: If there's only one spot open and two children. . .

CHALFANT: Then you get into a values game as to who might profit most.

JOHNSON: Maybe they all could profit from the same; but then do we use different nomenclature? Where would you put that little five year old you described earlier and do we need a double scoring procedure of what can he do and what does he do, such as on the Vineland?

MC CARTHY: I would put him in an LD program, that particular kind of a child, because he is going to develop a severe disability if already hasn't done so. If we go back to the original three, the real LD's then the ones that can profit from being in the regular class if we can change the curriculum and the level of teachers competence, and the multiply handicapped, we may be talking on a quantitative base also. We have our severe ones that need a completely modified approach to learning, we have another level that can learn in an auditory program but not in a visual, so that perhaps these are the less severe, and the multiply handicapped in which the learning disability may be either primary or secondary. Terminology may need to be simplified to differentiate these groups.

JOHNSON: I would use problem in some cases. I'm not sure we create a disability in the truest sense of the word. I think we can create learning problems but. . . Can you take number two and put him into category one just because he hasn't been taught correctly. In other words would you make an adult aphasic?

MC CARTHY: No, we don't make an adult aphasic. However, you do, at least as we were talking before, I think we can take a child who has not practiced the expressive language function and becomes a very nonexpressive child, a very quiet child, a nonverbal child, who will then not develop language structures. This child would be diagnostically indistinguishable from the child with delayed maturation of the central nervous system or the developmental aphasic child.

JOHNSON: But I think those patterns may be quite different. I think we're forgetting idiosyncratic or different kind of rule learning behavior in the child that doesn't talk.

MC CARTHY: What I'm describing is the population of children that we see in the public schools and that we do need to address ourselves to, being aware of the fact that I don't feel that all of them are LD kids, or that all of them can be differentially diagnosed. The thing that we find, from an administrative standpoint is that we have one halftime LD specialist assigned to a building. As she goes into a first grade, the teacher will say, "I wish you would take a look at these three kids, they're really in trouble, they're just not learning anything." If that LD teacher, our itinerant teacher, took a look at all three and said, "well these two don't have a learning disability and this one does, I will see this one, and not those," we would find ourselves in very serious trouble with our administration, with our teachers, with our community. In the public school, the LD specialist can't afford the luxury of being as discrete as I would like them to be. I am describing reality [illegible] my professional preference for neatness and order in our definitions.

BRYANT: In practice it's educationally handicapped rather than learning disabled. It's a general learning problem and you have to deal with all of them.

KEOGH: Essentially what the new regulations from California have defined is that there must be lack of achievement as a primary cause of referral but there are three related things that have been teased out. One is what has traditionally been referred to as the LD child with some sort of at least suspected organic problem, the second is the child with severe behavior problems of unspecified etiology, and the third is a child who has a psychiatric diagnosis of emotional disturbance. These are obviously not discrete categories.

MC CARTHY: As I look then at the population in the public schools, I think I'm looking at a broader category. But I do feel that all of us in the public schools need to know which are the children that would be diagnosed as LD by anyone's definition and to know then that our skills are relevant to the other children even though they're not learning disabled. I am continuing to define a specific group and I think we have to, but also recognizing that in the public schools we're never going to have side by side programs, one for the real LD child and then another parallel program for the children who are not learning for whatever other reasons.

JOHNSON: Like speech improvement versus speech correction.

MC CARTHY: Exactly.

KEOGH: Who are learning problems or achievement problems. I wonder why we must make that subdefinition?

MC CARTHY: Because the treatment plan that will follow will be a quantifiably different program. In other words, itinerant programs where the primary emphasis is placed on working with the classroom teacher, will address themselves primarily to the second group of children and not to the more severe groups. I'm very concerned, as I read our proposals on the current emphasis on mainstreaming. I think mainstreaming is fine for that second group of children but not for the first group. So that I find I need a neat distinction. I'll address myself to all of them simply because this is the need in the school. And the public schools aren't sophisticated enough yet and probably will never be because of funding and so forth to have the fine distinctions in service. But I also want to be sure that then I have a rationale for serving children in different ways, in quantifiably different ways.

JOHNSON: May I hypothesize one other possible reason? And that is the length of service that may be required. If you have a hardcore LD with some processing deficiencies, he's going to have trouble everytime he tries a symbol system; thus, we'd better be prepared to follow him through junior high and secondary high.

MC CARTHY: Also differentiated staffing I think is an important part of this.

JOHNSON: Some of the final diagnosis may come as you watch him approach each new symbol system.

MC CARTHY: And I also think as we look at programs, we are seeing emphasis on volunteers and teacher's aides and so forth. For the extremely complex children that I would put into that first group, we can't expose those kids to aides or volunteers. Our highest level of competence in the public schools needs to address itself to the program for the most severe disability and then to help train the people who are going to address themselves to those less severe problems.

KEOGH: By the same token, though, we can say that it's important that type two kids in your analysis don't get put into type one program.

JOHNSON: That's exactly right.

KEOGH: I'm more comfortable that the educational programming does follow directly from. . .

MC CARTHY: The distinction between children.

KEOGH: I think that's important.

MC CARTHY: The next point that I want to discuss briefly is terminology. I am concerned about the ambiguity of the terminology that is being used currently. Whether we use "specific learning disabilities" or "minimal brain dysfunction," or whatever, we are using nonspecific labels for behaviors that may deviate along many continua: academic, social, emotional, cognitive, linguistic, and physiological. The use of such nonspecific labels demands specific descriptors if the need of an individual child is to be delineated. Not all children for example with Minimal Brain Dysfunction will have special educational needs. And yet, we are being beset by pediatricians who are diagnosing children with minimal brain dysfunction and telling parents to contact their director of special education. It's hard for most of us to know, even after seeing the child, what the physician expects of the school. There really are no educationally significant derivatives of the label.

Minimal brain dysfunction, or learning disabilities, depending on who's using the terms at this time, appears to be a diagnostic cop-out for too many professionals who then relieve themselves of further responsibility for specifying clinical symptomatology, prognosis, and all but superficial and sporadic management. This is true not only of educators, but also of medical people and psychologists who feel they've done a beautiful diagnosis when they've hung the label on.

The term M.B.D. as a label for central process dysfunction appears to relieve all of those concerned of both responsibility and guilt for the problem. The child need not accept responsibility for the problem of his nonlearning because he can't help it. The parent need not accept the responsibility for his nonlearning because nothing he is doing is causing the problem. He is relieved to know it's organic. The teacher need not accept responsibility for the nonlearning because the child is brain damaged, and everybody knows you can't do anything about that. And yet we know that many more children are victims of poor teaching and curricular inflexibility than are victims of specific learning disabilities or minimal brain dysfunction. Somehow the futility which seems to attach to the label minimal brain dysfunction and perhaps in less degree to severe learning disabilities must be modified to include some dynamic hope for change. Perhaps each professional who so labels a child needs to include some committment to such developmental concepts as maturation of the nervous system. Someone this morning mentioned the fact that we can remember the era when we thought that if you were once a dyslexic you were always a dyslexic. I think somehow or another we're still hung with that in the public schools. We need to get across such developmental concepts as maturation of the nervous system so mother can say, "well my child used to be minimal brain dysfunctioned, but isn't anymore." That type of idea seems to have been forgotten. Or another developmental concept is the development of collateral engrams or pathways. We accept that in adult aphasics but somehow or another the people who are using this terminology with children do not communicate that to the parent or the teacher. Or perhaps an emphasis on the child's ability to modify or adapt his own behavior. We have too many kids who will come to school and will say to the teacher, "I can't help it. I haven't had my pill this morning." They're so convinced that the pill is the only modifier of their behavior that they have that without it, they feel they're helpless. Somehow or another we've got to get back and emphasize with the child that he does have the ability to modify or adapt his own behavior even if whatever people have said about him is true. Another developmental concept that we need to increase our awareness of is spontaneous recovery of function or use. We know that that's true in adults but we don't seem to remember it with children. Or the positive response of the characteristic behavior to training. Too often we'll train a child so well that he is able to do a beautiful job in reading, and yet someone is still labeling him a dyslexic or a reading problem. That is all that I really wanted to say about terminology, since we have already belabored terms for too long in this field.

BRYANT: Could you give one or two examples. You told us what diagnostic cop-out and you gave some general terms, but what would you actually put as a label on a given child?

MC CARTHY: Well, for example if we are talking about a child with a specific learning disability, I want to know the educationally relevant characteristics of that learning disability. Can he not talk? In other words, is it an expressive language problem? Is it an auditory memory problem? Then we get into the processing. I want to know what process is involved in the learning disability. I think just using the generic label which is being done at my level of function is doing children and teachers an injustice.

BRYANT: So something much more specific then central process dysfunction.

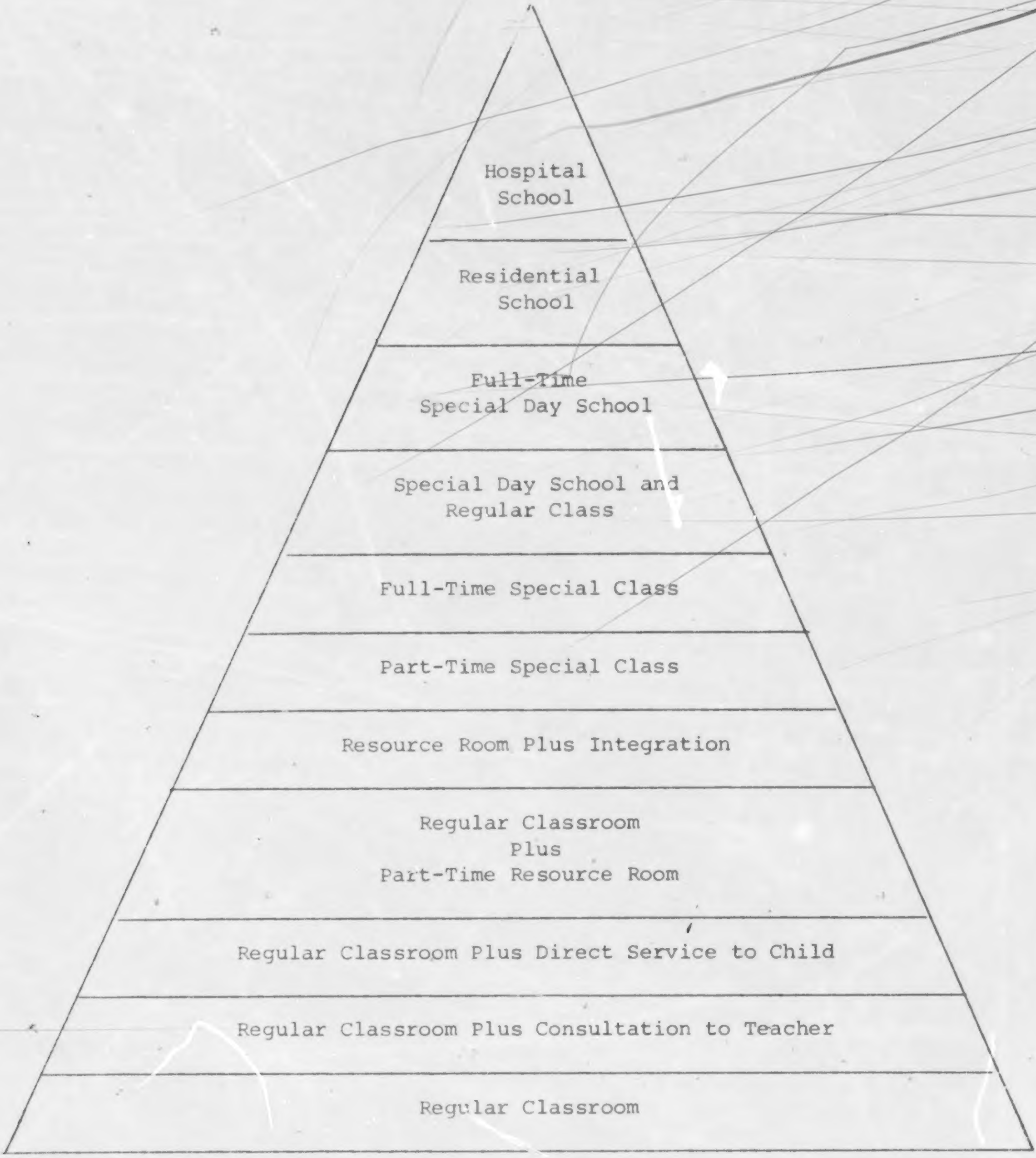
MC CARTHY: Yes. I want to know what's wrong and to what level has it developed.

CHALFANT: This can all be said very behavioristically at task level, we really don't have to confuse people with abstractions and theory.

MC CARTHY: I have two transparencies that I'd like to use. Both of them are modifications of Maynard Reynolds model of a hierarchy of services. Let me start with that one first because that's the one you're most familiar with, the hierarchy of remedial services in the public schools. Unless we specify the extent of the disability and the nature of the disability, we're much too inclined to move children from the regular classroom all the way up to a fulltime special day school, as is happening in Boces, for example, where the classes for learning disability children in some areas of the state of New York are in separate buildings apart from the regular schools. The idea of moving a child with a learning disability from the regular class where you find him all the way up to a fulltime special day school instead of trying him in all these other levels of remedial service is creating some of the most severe problems in the field of learning disabilities at the public school level. I am sure that we do not have to move every child up through each level of remedial service, but I do think we have to have options available to us in the public school and to realize that some children can be handled in the regular classroom with consultation to the teacher, the mainstreaming model that's hitting us in so many of our proposals. Or in the regular classroom with direct service to the child. This may be the level that we need to move that child to. Or the regular classroom plus parttime resource room help, much like the hard of hearing model. Or he can be placed in the resource room, but be integrated back into the regular class for part of the day.

All of these options that are viable options and that need to be available in the public school system, need to be known to the people that are pressing us from the outside. We have many situations in which the physician will tell the mother the child needs to be in the special class. We may be providing service to the child in the regular classroom plus parttime placement in a resource room. In this plan he is placed on the first grade teacher's class list in September, and when he comes in the morning, he puts his lunchbox there, takes his coat off, and is part of that class, then goes to the resource room for part of the day. Somehow or another in the public schools we haven't communicated to other people who are pressing us, largely pediatricians and pediatric neurologists and clinical psychologists in private practice, that we have options that are available where we try to match a child with the intensity of the service that he needs depending on the severity of his disability.

HIERARCHY OF REMEDIAL SERVICES IN PUBLIC SCHOOLS


Hospital School
Residential School
Full-Time Special Day School
Special Day School and Regular Class
Full-Time Special Class
Part-Time Special Class
Resource Room Plus Integration
Regular Classroom Plus Part-Time Resource Room
Regular Classroom Plus Direct Service to Child
Regular Classroom Plus Consultation to Teacher
Regular Classroom

From Reynolds, Maynard, *Exceptional Children*, Vol. 28, No. 7, March, 1962.

HARING: What's the difference between special day school and regular class, and full time special class. And, in terms of that placement hierarchy, shouldn't those be reversed?

MC CARTHY: No, if you look at special day school and regular class, there are some models that are coming up where the child goes to the special day school in the morning and comes back to our building in the afternoon. So that's a little more. . .

HARING: In terms of special education, isn't that a little less intense?

MC CARTHY: Than fulltime special class? Yes, except it moves them out of the public school stream which is the only reason that I put it as a little more specialized because it gets him out of public school and into a private school.

Then you have the fulltime special day school, usually private school models but sometimes they are public school models also. The only reason I put in hospital school, I'm not sure Maynard had it in his original model, is that in Louisiana that was the model that the parents were pushing for, only because state funding was tied to hospital schools.

This particular model is one we need to carry in our heads as we're trying to program for children or make recommendations for children in public schools, instead of assuming there is only one level of intensity of service available. This of course has ramifications for teacher training programs because we need to train people to function at a variety of levels because they're going to be called on to function in that way in a school situation.

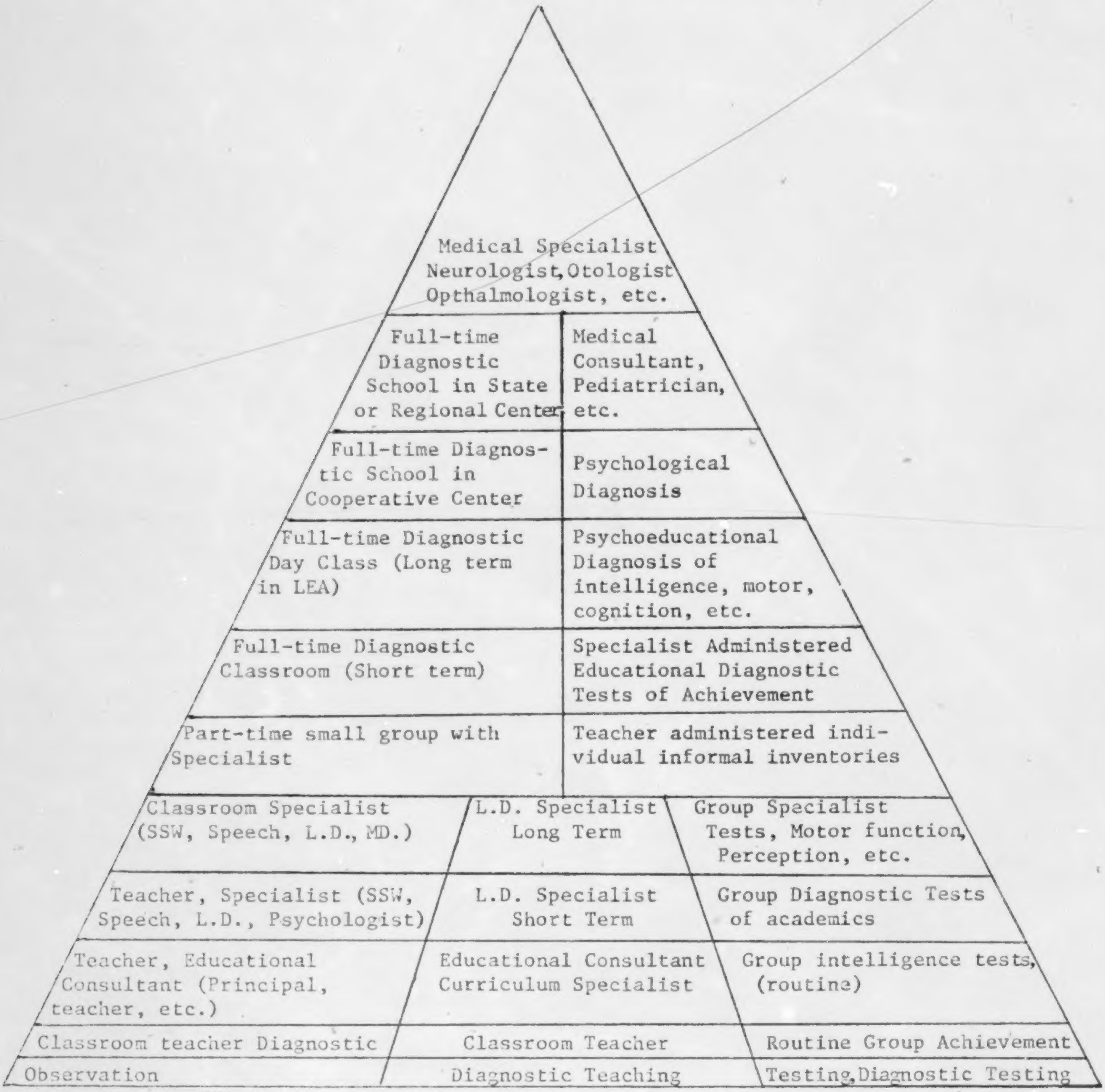
I've taken this concept of a hierarchy of remedial services and tried to apply it to a hierarchy of diagnostic services. We find we need to collect diagnostic data in the school system in three ways: by observation, by diagnostic teaching, and by diagnostic testing. Much of the difficulty that we have been living with on the misplacements of children or the inappropriate testing data result from the fact that too often we rely only on diagnostic testing and not enough on diagnostic teaching and observation.

This model implies that a variety of people can do the diagnostic observation, a variety of people may need to do the diagnostic teaching, and a variety of people may need to be involved in the diagnostic testing.

We start at the least intense level of diagnostic observation and that would be at the teacher level. The classroom teacher needs to be trained to do diagnostic observing. By that, I mean I want her to look at a behavior and ask herself why did he do that in this situation when he can't do it in that situation. Why did he fail in what I just asked him to do when he succeeded on something very similar yesterday. The teacher is taking the behavioral data in the classroom and thinking about it and asking herself questions.

The next level of intensity of diagnostic observation would be the teacher in consultation with an educational consultant of some sort. It might be just the principal or it might be the teacher across the hall who has had more experience or who had the child last year. At this level the teacher is getting some input from someone else to confirm or deny what she thinks she has seen or what diagnostic hypotheses she's arriving at.

HIERARCHY OF DIAGNOSTIC SERVICES IN THE PUBLIC SCHOOLS



Medical Specialist Neurologist, Otologist Opthalmologist, etc.		
Full-time Diagnostic School in State or Regional Center	Medical Consultant, Pediatrician, etc.	
Full-time Diagnostic School in Cooperative Center	Psychological Diagnosis	
Full-time Diagnostic Day Class (Long term in LEA)	Psychoeducational Diagnosis of intelligence, motor, cognition, etc.	
Full-time Diagnostic Classroom (Short term)	Specialist Administered Educational Diagnostic Tests of Achievement	
Part-time small group with Specialist	Teacher administered individual informal inventories	
Classroom Specialist (SSW, Speech, L.D., MD.)	L.D. Specialist Long Term	Group Specialist Tests, Motor function, Perception, etc.
Teacher, Specialist (SSW, Speech, L.D., Psychologist)	L.D. Specialist Short Term	Group Diagnostic Tests of academics
Teacher, Educational Consultant (Principal, teacher, etc.)	Educational Consultant Curriculum Specialist	Group intelligence tests, (routine)
Classroom teacher Diagnostic Observation	Classroom Teacher Diagnostic Teaching	Routine Group Achievement Testing, Diagnostic Testing

McCarthy, J. M. Education: The basis of the triangle. Proceedings of M.B.D. Conference, N.Y. Academy of Science (unpublished), 1972.

The next level would be the teacher in discussion with the specialist where she can tell the social worker or the LD specialist or the speech therapist or the psychologist what she saw and get some confirmation or lack of confirmation or redirection.

The same with the classroom specialist who then at another intensity of observation will go into the classroom to observe. This would be the psychologist going in to say "I can't quite figure why he would be doing this from what you tell me, let me go and watch him for a little while."

There are some diagnostic problems that can be solved at this level, there are some that need that level, there are some that need to be moved up gradually, but I don't think that we need to jump from a teacher with a problem at the first level to a diagnostic classroom for example which is happening in some parts of the country or to a specialist who then sits down and tries to work with the child. I think we need to ask the teacher to perform a diagnostic observational function.

But I also think we need a parttime small group with a specialist where the LD specialist may bring a child into a small group that she's working with to see what happens as she watches him interact.

We also need some fulltime diagnostic classrooms. I've seen some on a short term basis. Some of the projects submitted under Title VI-G have this built in, where they'll bring a child into a center for three or four weeks or three or four months until they've had a chance to observe him. In our district, we have fulltime diagnostic day classes where we place the children who don't fit the nice neat boxes or the traditional categories. We will pull them into a preprimary diagnostic class for instance when faced with a diagnostic dilemma involving some element of mental retardation, some element of severe learning disability, and some element of emotional disturbance and when we're not sure which one is primary. We may not be sure where to stream the child from here. We don't want to place him in an EMH class if we think there may be some other element functioning.

Then we need some fulltime diagnostic schools perhaps in a cooperative center.

When we move into diagnostic teaching the second column in the diagram, we feel that too many teachers do not see their teaching task as a diagnostic task. Yet everytime they say to themselves, "this isn't working very well, I think I'll try this," they have done a formal diagnosis. Teachers need to be aware of the fact that this just is as valid a way of assessing the child as any of the other techniques that we use. Learning disabilities specialists need to be aware of the fact that part of their function is an assessment function, that they don't need to jump from testing directly into remediation but need to spend time in diagnostic teaching as an extension of the assessment. They also need to be aware that the learning disability specialist probably is the long term diagnostic teacher, and can get involved in such techniques as continuous measurements. As they do continuous measurement on the child they are teaching, they are in fact involved in long term diagnostic or assessment kinds of teaching where they are sharpening their focus and changing their teaching as the child changes rather than starting with the diagnosis over here from some eminent authority and staying with it long after the child changed.

The same is true as we look at diagnostic testing. Teachers can and should utilize a great deal of diagnostic testing information that they have available right now. Too often teachers do little in utilizing the diagnostic information available to them.

JOHNSON: They always think it has to be new and unique.

MC CARTHY: What we do traditionally in the public schools is to accept a referral from the teacher to the psychologist. So what we've done in fact is start here and jump all the way up here without utilizing all the levels of diagnostic test information that are available to us. In terms of efficiency, very often we can stop right here at the first level, with the child if-we use the data the teacher already has, for example, the Primary Mental Abilities Test. Or I use routinely the Metropolitan Reading Readiness Tests. This is a group achievement test theoretically. As I sit and do our staff conferences on children that are being screened out of the kindergarten because they need something other than first grade, we look at the first two tests on the Metropolitan. They both test listening and auditory channel functions If those two are low, we can assume that we've got an auditory problem. The child's listening skills that day when he was being tested were not operating on a level that would suggest that he could succeed in first grade. By the same token if on the matching and the copying subtests, he's extremely low, and we find a great deal of difference on his subtest scores, I can hypothesize a visual motor dysfunction of some sort and flip over to the back of the Metropolitan book to the Draw-a-man test and then ask the teacher to let me see how he writes his letters and numbers, and I've got a lot of diagnostic backup for whatever needs to be done without jumping from level one to level eight. I don't want to take too much time on that, but the fact we have a substantial body of diagnostic information in the public schools that has been wasted says a lot to us about the efficiency component of our assessment procedures.

One other broad area that I would like to discuss relates to etiology. What can the responsible educator say when the parent asks what has caused the learning disability in my child? This is one of the most important and significant questions that parents ask, "why is my child this way." They ask it in a variety of ways but it is the question underlying much of their anxiety. Right now, with most of these children, when a person asks why, what caused it, the most reasonable and accurate response for the educator at this point in the development of knowledge, must be both equivocal and openended.

As far as I can see, we probably have six causes of nonlearning in children. First, genetic variations in the function of the central nervous system. Second, chemical or physical trauma or infection in utero, as in the case of rubella, blood imcompatibilities, ingestion of drugs by the mother, and so forth. Third, trauma during the birth process. Fourth, trauma after birth, including damage to the central nervous system due to chemical or metabolic trauma or infections during childhood (encephalitis, meningitis, galactosemia, and all the other things that happen). Fifth, delayed maturation of some of the functions of the central nervous system perhaps due to inadequate sensory stimulation and resulting biochemical imbalances. And then sixth, none of the above. I think every one of us has to throw that in if we're going to be realistic and accurate. Teachers need to know that they should not hesitate to say they don't know. Too often teachers feel that someone else knows all the answers and they don't, so they are embarrassed to say "I don't know." That is the only comment that I want to make about etiology.

KEOGH: Would you be willing to buy poor teaching, lack of opportunity, and some other things, in your group two?

MC CARTHY: I would not say poor teaching if I'm talking about the real LD kid. If I'm talking about our whole population yes, and curricular inflexibility.

BRYANT: Of course the real LD kid may have had poor teaching too.

MC CARTHY: The final point that I would like to make has already been discussed so I can be brief on this. As I was preparing for this conference, I felt a very urgent need to formalize for myself a theoretical base of operation. It was very interesting to me as I started to do this to look to see what were all the inputs in my life that I could pinpoint that have had an influence in helping me to arrive where I am in terms of what I think about learning disabled children. It was very interesting because I ended up with quite a conglomeration. This might be a very interesting game to play, to ask each of us to write down a list of influential thinkers that have really moved us to the point where we are, because if we know what our historical antecedents are maybe we'll be able to see more differences than there seem to be. But I found for example that I've been strongly influenced by Hebb, Piaget, Osgood, James Miller, Skinner, Mowrer, Schecter, Hunt, Powell, and Kirk. I'm not sure that I would ever come to a finite limit on the influences.

But what I surprised myself with is that I'm moving much closer to an operational awareness of the influence of the emotions and the personality of the child on his learning styles. This is why I liked some of the work that Schecter is doing right now in talking about sensory-input underload and overload. I think many of the children that we're seeing as learning disabled can be subsumed under those two rubrics of sensory input underload or overload. For example, some of our economically deprived children have distinct patterns of learning. We know that many of them come from very noise-polluted environments. This could then in some ways account for the need that many economically deprived kids have to tune out auditory stimuli. They have to have some ways of balancing the onslaught of what is coming in. We could explain the cognitive styles that we see in them in terms of a response to sensory input overload. Where some other children, for example those that end up as auditory-vocal deficits because of middle ear infections in early childhood, could be seen as the result of sensory input underload, they haven't received the auditory stimuli. In other words, the sensory underload and overload is a theoretical formulation that appears to account for a wide variety of learning disabled children now included in this category of the handicap. It's just sort of where I am right now theoretically.

CHALFANT: You mentioned processes, situational factors, how emotions affect style and poor instruction. I'm just wondering if your theoretical formulations placed these into any kind of hierarchy, which makes a difference as to what one would look at first, second, third, etc.

MC CARTHY: No. I haven't gotten that far with it, but one of the intriguing studies that I'm trying to process right now is some work that's been done by

Powell at Johns Hopkins on failure to thrive children. In working with these children with a medical diagnosis of failure-to-thrive, they did blood assay studies and found an absence of pituitary gland hormone in the blood of these children. Instead of coming back at them with shots of pituitary gland extract, they came back at them with tender loving care and then found the next time they did a blood assay study the pituitary gland was functioning. I am very intrigued by the application of that kind of a finding to what we can do in the public schools. It would certainly argue, if you extended it far enough, against a pill as the answer to the problem which is seen by too many people now in the schools. So I haven't set up a hierarchy.

CHALFANT: It may be the accessibility to instruments and procedures which dictates our hierarchy. I'd probably want to look at emotional factors and situations before I would investigate psychological processes.

MC CARTHY: I think this leads back into Norrie's bag too on working with the behavior. I'm not sure that it's the counting that's doing it or the fact that the children do change not only in response to what the teacher does but what she is. I think this is what we try to sell to our teachers.

CHALFANT: There are two questions: what? and why? It depends on how much you want to concern yourself with why

KEOGH: You've talked a lot about diagnosis and it's come up a number of times. You acknowledge Kirk as one of the major influences on your own thinking and I suppose Jim might list him too. You both use the I.T.P.A. and you both use some of the constructs that are involved in that test. Do you feel that it is an adequate kind of instrument to get at what you're after and do you feel comfortable with that analysis of process?

MC CARTHY: I see the I.T.P.A. as a piece in a diagnostic or assessment battery that very often will point to additional information that we need to gather. It'll send me on an intuitive or clinical base to either additional assessment information or to diagnostic teaching to confirm what we find there.

CHALFANT: May I comment briefly. Georgia's really the authority on that instrument since she worked with the standardization of the new revision. Just a few words and Georgia might want to comment further. In terms of a child with a language problem, I think the I.T.P.A. is helpful because it gives you a survey of various psycholinguistic abilities. You can go in much more precisely on any one of the subtests with informal procedures and other tests and get more information if you need it. So it's a very good surveying instrument for a child with a language problem.

KEOGH: I couldn't put together something that Jerry had said earlier in terms of making objective something which is in fact a construct or a concept. It seems to me that that's one of the dangers of a test like the I.T.P.A. It's derived from a theoretical model, it presumably operationalizes certain presumed functions, and when you score it you say aha I've measured "it", while in fact what you've measured is your construct.

CHALFANT: You don't say that when you use it.

KEOGH: I know that, but you're making the assumption that the process is real and in fact is something that characterizes the child.

SENF: This is exactly one of the examples; a test like the I.T.P.A. does not get validated in anywhere near the finegrained manner it should, i.e., it's generally put right into use as an instrument to examine something else namely children with disabilities. You come up with statements about a child scoring high or low on a certain dimension. Now it happens that that dimension has not been left undefined but, indeed, there's a name associated with it. So it's only natural you assume that the child with a lower score has less of that name. But the name may not be a valid label for the dimension tested. Also, it's very possible that a lot of the named dimensions on that test are redundant. The notion of testing specific discrepant models is that you can begin to eliminate unnecessary terms. Progress will come when we can stop the proliferaton of processes describing aberrant functioning and start using adversary models to restrict the number of terms. For example, say you find a child who does poorly on most visual tasks. When you present him something visually he can't remember it. You can say he's got bad visual memory but it could be equally possible that the child long ago reduced the amount of processing capacity given over to visual information so that the memory deficit is entirely redundant with some other more basic deficit. The problem here is it's naive to have a model which implicitly posits that the mediating processes are independent, thus allowing a given child to have any number of deficits. Perhaps he only has one deficit which places limitations on his performance on a wide variety of tasks, including tasks thought to measure other processes. The logical strength of the I.T.P.A. requires that the underlying model be further validated. It's unfortunate that the test was constructed at a time just before the Osgood model began to loose favor because that underlying model never really underwent the necessary testing. Chomsky's brand of psycholinguistics took hold and the psycholinguistic area no longer was concerned with research on the Osgood model. It's really not the fault of the people who constructed the test; it just was unfortunately timed. . .

KEOGH: I didn't mean to pick on the I.T.P.A. I just wanted to conceptualize it for me in terms of other kinds of diagnostic information.

SENF: The point is that validation doesn't come by vote or by even differential consensus of experts but by some strict validation procedures whereby a term gets linked in some theoretical network and with empirical correlations with events that have meaning in the real world. You can't correctly obviate that step. In practice one can obviate the step obviously because it's done all the time, but it's incorrect to do so.

KEOGH: What I was really getting at is does the model provide you with what you feel is a satisfactory way of getting at what are the presumed processes which are deficient in the learning disabilities child?

MC CARTHY: My answer would be that in our school system we use the I.T.P.A. like we do any other assessment instrument. In other words, if we've given a WPPSI to a child or a WISC, we take a very careful look at the discrepancies in function, where they do well on one and not on another. We may also get similar kinds of patterns on an I.T.P.A. and then we match this to the description of the teacher of the behavior of the child. We can say, aha, if he's doing this and he's doing this on this test and that test, maybe we do have a process dysfunction. Then we'll begin to work with that particular process. But usually we relate that process to an academic task because our LD teachers are all very much concerned with the academics. So we don't do the kind of training in isolation of a hypothetical construct.

For example, on the developmental first grade children we will routinely do I.T.P.A.'s on all the kids and then we do a group profile. The group profile, is a profile based on the median score on each of the I.T.P.A.'s subtests for all children. We will use that kind of information to select equipment, materials, tecching methods. We see the class has auditory-vocal deficits, we'll come in very heavily with tapes or cassettes at the four and a half year level rather than at the six year level, if this is where their median is. We use the I.T.P.A. directly in that kind of way, as well as individually with the child as it relates to the academic task we're trying to teach. It is a part of a total assessment battery including the diagnostic observation and diagnostic teaching.

I always ask teachers when I want to know what they think of material, if you could only have one thing in your classroom next year what would it be? If you asked me that same question, if I could only have one technique or instrument in my assessment battery what would it be, I think it's clinical observation. It wouldn't be any test.

KEOGH: Yes, I would agree there.

HARING: I'd score that correct.

SENF: I only have one other comment germane to your remarks that I think is best said now. When you divide a large population into subsamples I think that one of the things that we haven't been too careful about in this field that psychopathology has dealt with is that there are many logical and legitimate ways to divide up a pie. You have to be aware of the dimensions that you think are the relevant ones when you make that division. What is relevant is defined in terms of what you want that division to do for you. In Zigler and Phillip's classic article, "Psychiatric Diagnosis, A Critique," they point out that you have to have in mind what it is you wish to have that category system do for you before you produce it. If you want it to have prognostic implications, you may construct a very different diagnostic system than if you wished it to have etiological implications. One system may not serve all the tasks required of it. It was the hope of category systems based on disease models that a single diagnostic system would be sufficient, each category representing a single disease. Each category was to be defined by symptoms, behavioral observations, plus perhaps some inference on the part of the physician. Once a person were classified (diagnosed), the disease's etiology, course, prognosis, and appropriate treatment would follow as correlates of that category. About the only category within mental illness that worked so nicely was general paresis. Zigler and Phillips, nevertheless, were arguing not to get rid of categorization but to consider multiple ways of categorizing depending upon what kind of functions one wished the system to serve. So that if one begins to look at categorization this way, you can divide children into groups which suggest various kinds of treatment program as Jeanne is doing. This category system may also suit the legislator, perhaps not. A person interested in process research like myself may seek a category system separating children according to their ongoing psychological functioning. Such categories may have etiological correlates but need not. I suggest this is a better diagnostic system for my purposes and also believe it will prove extremely useful in constructing remedial programs but this is beside the basic point that one has to ask what the system is for and then design one that's appropriate. Categorization need not be reification of some hoped for true state, but really is a working tool which can do many different jobs; we can have different system for different functions. As you're pointing out Jeanne, this system one that you devised is very workable dealing with the child in the public school and certainly could be thought of as that and not as something that we all have to accept or reject.

CHALFANT: Jerry, on listening to your comments on labeling and categories, I'm trying to think of the people who make up these categories and labels. Who are they? Who are the label-makers and the categorymakers? They are administrators, researchers, and professors. But many times, as you've indicated, the purpose for which the label was used is overgeneralized, loses meaning, and a lot of bad decisions are made and programs are formulated because of it.

JOHNSON: Another factor cutting across that. The term severe learning disability may be bad, in a lot of instances it's specific learning disability, because you get minor hardcore LD that are less difficult to deal with. Let's say you get a real retrieval problem where you know that person has real auditory recall problems. You can find it sometimes when they're bilingual as well. And that may not be as severe as some longterm educational social problem. In other words, I don't think the word severe should be used for what you're calling the hardcore LD because there are minor, moderate, and severe within that category.

MC CARTHY: What concerns me, and I haven't mentioned that at all, is that we don't seem to be able to predict very accurately which child will remediate easily and which one will not. In fact, we would have been wrong in several specific cases where children looked like it was just sort of a minimal kind of thing that we could wave our wand at for a couple of months and it would go away and they have proven to be the most resistant.

JOHNSON: That's quite true. And we've been taking a few cases we have followed for the last few years and have discussed them with students in practicum. Given the data from kindergarten we asked the students to try to predict various learning problems. And I think it's important for students in training to see these kinds of data and the children that resisted the training.

We need to keep careful record of all methods that have been used so that as a child goes through a school, we know that he's had phonics. Thus, it's not tried many times again if it was unsuccessful. We need to know the methods that were tried, how long they were tried, and which children did not respond to them.

HARING: I think prediction is more available to you then you think it is. In fact, you should be able to predict fairly accurately within a couple of weeks what period of time of remediation it will take to get to desired rate.

MC CARTHY: Using your. . .

HARING: Yes. That should not be a big problem for you at all. I don't mean to oversimplify it but it's very possible to make good predictions. It's a matter of trendlines based upon two weeks of continuous measurement. Set desired rate, draw the trendline out, and it's pretty close how long it's going to take.

CHALFANT: On that task.

HARING: Or classes of tasks, encoding let's say.

JOHNSON: But you would not necessarily be able to predict whether a child might have trouble with reading or math or music.

HARING: You run them on all the tasks.

STROTHER: Can we stand away from ourselves for a moment and look at the group process. My perception is that our conversation's getting a little desultory here, not that it's not animated, but we're moving off in a variety of different directions. I suggest that that indicates a point of diminishing returns for a structured discussion. So I'd like to ask Dale to comment a little bit on what he would like us to do with these questionnaires and with the tape recorders over there.

BRYANT: May I just suggest that there's some alternatives. One is that we went through and thought what's likely to happen is the group will talk from different positions and we have the job of extracting this from one person and this from another. Then we'll say what does so and so mean by learning disabilities. Are they conceiving of learning disabilities in terms of everyone with learning problems and with subgroupings or are they thinking of neurologically impaired, etc.

Now in addition to the questions at the very end on definition that we thought would help peg you so that we could get your statement about definition instead of us just inferring it, we were thinking also that there are some general questions that allow us to take the same stimulus and see how you're responding to it.

Now the group might want to reject the whole idea of the questionnaire, they might deal with it rather briefly, or they might want to do this as the basis for further elaboration. We did think that the majority of people would not want to write a great deal and so we have four dictating machines that you can use to answer this. It would be possible to meet at ten o'clock tomorrow so that it would give a little time tomorrow or tonight to answer these kinds of questions. Or we could try to do it in group or maybe any other procedure. Or else it's possible to say we've had it and we don't really want to go this way.

CHALFANT: Dr. Strother, I'd like to address this question to you as chairman. In view of the discussion we've had and the presentations, as an alternative to this, what kinds of things should we do other than the questionnaire to get closure on what's been done already? I would be interested in hearing discussions of points that have been raised and questions that people have. Somehow I sort of hate to stop the interaction and the questionings and the thinking that's been stimulated.

STROTHER: I feel this way too even if we should take this home with us and answer this after we've had a chance to reflect on it a little bit. I think too we're beginning to approach a definition of some things on which we can reach some real communication and agreement that will give us a sense of direction. What I would be willing to do would be to spend some time tonight to try to structure this in one way perhaps and then open up that structure tomorrow and see whether it's a satisfying structure to deal with.

HARING: I'd like to try to use the group process in a composite way to respond to the questionnaire because the discussion that we usually are able to stimulate here seems to be of higher quality than most of the responses I make to a questionnaire like that.

KASS: That's perfectly compatible. The only thing I will say with regard to the transcriptions of this meeting, these will be sent to you for whatever editing and your suggestions regarding whether this should be proceedings added to our report or incorporated in our report. I think seeing the product will give us some notions and we would appreciate your recommendations.

CHALFANT: Is this a report to the Office?

KASS: Our reports to the Office of course are broader than this one aspect. This aspect we wanted to tape completely and have transcribed and then make the decision whether these would be in the form of proceedings to be added as a report of a separate meeting or whether it is better to incorporate it into the whole. And we would welcome your suggestions there.

JOHNSON: If you continue to push us on the very basic questions, I think they could be put in a composite form so that some very basic issues are put before the field. And I think your direct probes are very useful in teasing out both the similarities and differences of philosophies. It has brought more communication.

STROTHER: Let's try something just for fun. Suppose, and I wish we had microphones so that I could shut off the hearing of everybody except one, but suppose you were asked what do you consider to be the single most critical question in the field of developmental disabilities at this point, what would your immediate answer be without thinking about it very much? Let's see how much agreement there is. What do you consider the single most important issue in the field of learning disabilities at the moment? Some of us I suppose will speak to the issues of research, some to the issues of training, some to the issues of service, and so on but let's get those biases out.

HARING: I would see at the present time, if it were a forced choice response, the more precise, not definition because I'm not sure we need a definition at this point until we can get a more precise description of the academic responses that fall within categories that all teachers would agree are disabilities. I would like to see responses that we know they are scattered all over because we know that there are spelling disabilities, reading disabilities, computational disabilities, and writing disabilities.

STROTHER: Let's not go into these suggestions very far at this point. Let's get back to it because this raises a number of questions in my mind I'd like to get to, too.

Maybe we'd better rephrase the question: What for you is the most important problem in the field. Then you may respond from your own point of view rather than trying to take a more universal point of view.

HARING: Just a subfootnote there. If disabilities are in fact learning pathologies, I want to know about them.

JOHNSON: I think we need to work on the parameters and the relationships between those parameters that describe the total organization of learning and behavior of a child. We need measures and a system for studying the relationships between those measurements that will effectively tell us about the nature of the child's learning disability.

KASS: I'm playing this game very strictly and I'm trying not to think too far into it and just off the top of my head what comes is: What does it take to treat developmental deviations and that's in terms of money, personnel, and facilities.

KEOGH: I think my basic concern has to do with the delineation of the interactional relationship between child parameters and situational or setting parameters.

JOHNSON: If we put these in a hierarchy, we could have a whole series of studies.

WIEDERHOLT: If I understood you correctly, it was the single most prominent problem in learning disabilities?

STROTHER: As far as you're concerned, what's the most important problem?

WIEDERHOLT: To me it would be the demands placed upon us for service and the inadequacy of the people who are currently delivering the service which relates back to an inadequate judgment and research base.

STROTHER: Would you be content with this formulation of it? How could service delivery to this population best be provided?

WIEDERHOLT: No, I would rather leave it as it stood. Essentially we're being demanded to do too many things and we're doing it without adequately trained people and without adequate understanding of our field as a total which will cause us, I think, in the long run to go by the wayside like remedial reading or. . .

CHALFANT: How would you state that in question form then?

STROTHER: Would you say something like this? What are the priorities in the improvement of our delivery of services?

WIEDERHOLT: No, because I think we know what they are. We talked about them for two days. It's the fact that there's a demand here and we don't have the supply to meet this demand so that other factors are impinging upon it which causes our products to be less than perfect.

STROTHER: Now that's a problem. But can you state a question that will lead us to an answer?

CHALFANT: How can we solve the problem of. . .?

WIEDERHOLT: Of meeting the demands for service. Or meeting the demands to provide for service of efficiency in view of our present status.

STROTHER: Jim, what's yours?

CHALFANT: This may reflect my recent conversation with Norrie, I'm not sure. To what extent does knowledge of psychological processes, their dysfunctions, and knowledge of cognitive style help us in developing and selecting assessment procedures and remedial methods.

HARING: That's a cute response. That includes at least three priorities.

BRYANT: Well, mine is very similar and it's in the general area of aptitude-treatment interaction. Basically it is what are the interactions between dysfunctioning, which implies a definition of the various disabilities in terms of the various dysfunctioning, what are the interactions between the dysfunctionings and treatments. I think that's kind of the crucial thing that's missing in our research base and that also would imply a system of characterizing treatments. If you wanted to expand it, it would have to be in terms of how can we define dysfunctioning, how can we define treatment, and what is the interaction between these. That might be a better statement of it.

STROTHER: It seems to me that two of these are very much the same. I think you're asking the same questions as Norrie is and I think I would ask that question too. Parameters and relationships.

JOHNSON: And I also mean there not only *intra*child, but interaction variables.

KEOGH: Mine, I think reflects my concern with the tendency to think of a child who is having learning problems as the sole source or cause of the difficulty. I think so much of it is a function of the setting in which he is that that must be included in terms of assessment, planning, and so forth.

STROTHER: It's apparent from this that we've got differences in the scope of the questions as well as the direction of the questions. Can we take a look at that for a minute and try to simplify some of the more complex questions so that we set up kind of an order of attack on them. Norrie, of course, wouldn't stop with this question. He's stated what seems to him to be the first question to ask. And yet some of these others having more complex components don't specify which of those ought to be looked at first. So could we go around again for those that are more complex and ask what would be your first approach to this. Then we'll get them all in the same plane as Norrie's question.

The one having to do with service is clearly in a different area than the others so let's recognize that as one dimension that we've got to address ourselves to but just put it on the table until we've looked at some of the others first.

Suppose we take this one about parameters and relationships, what would be the strategy of attack on that? Yours brings in a different one, because yours brings in the treatment dimension. The other two really are concerned with the description dimension, defining parameters and interactions that describe a population. And so that seems to be a less complex approach than yours.

KEOGH: And that would presumably provide the basis for remedial direction.

CHALFANT: I think the first half of mine is allied with theirs in terms of knowledge about processes, dysfunctions, and cognitive style.

BRYANT: I think this would be the first step involved in mine too.

JOHNSON: Or the question that comes through yours is, does anybody really need to know this? Isn't that what you're saying?

CHALFANT: Yes. That's why I put it in combination with the others.

STROTHER: Well now, Jim, I see yours in a little different way which was my reason for not thinking of it first. It seems to me you're asking two sorts of things. You're saying turn to the present state of our knowledge of cognitive process dysfunctions and so on and then measure the therapeutic or predictive efficiency of this present knowledge. And I think some of these other questions are implying that our present knowledge is inadequate to do that yet, so maybe those questions would take a kind of chronological priority.

BRYANT: Were you limiting it to the present state of knowledge?

CHALFANT: It's limited in my mind. I'm with him.

KASS: I must define what I said in the word treat, what does it take to treat, I did not mean remedial treatment.

STROTHER: I know. Handle the whole problem and therefore your suggestion too covers a whole range.

KASS: The place I would like to start would be with the population that we have however poorly defined, the treatment procedures, assessment procedures and environmental and then move to the interaction of these. So, it's like starting with the broad question and moving into the bits and pieces and I thoroughly agree on the interaction.

STROTHER: Would it be agreeable to do this. Could we address ourselves to the problem, how would you proceed to identify the significant parameters of learning disability, leaving aside the question of service delivery. Now Norrie I think suggested this by saying that he would proceed by asking teachers to identify children who had problems, then starting from what the teacher said those problems were, proceed to a more explicit description of them by. . . go ahead, fill that out a little.

HARING: By pinpointing the exact or precise academic behaviors that caused them to identify or pinpoint these kids.

STROTHER: Let me just ask one more question here. What would be your next step from that?

HARING: My next step from that would be to order or list and describe those behaviors that teachers pinpointed and then I would carry this beyond that in terms of developing tasks or cues that would prompt children to respond. That's not the end of it, but that would be the next step. I'd develop a series of sounds, of words, broad tasks that cause children to respond.

STROTHER: Is that clear to everybody what that strategy would imply? All right, Doris, where do you go?

JOHNSON: Interesting question. We could spend a lifetime on all children studying the parameters that are necessary for learning. I guess rather than just academic achievement I'd start down as low or as early as we could possibly begin, e.g., with preschoolers. Then we would begin by describing the behaviors as carefully as possible--trying to investigate the variables that facilitate learning and language acquisition.

In schools I would hope that the perception of learning is broad enough so that teacher does not pick up only behavior, language, or reading problems.

STROTHER: What else would you pick out? What would you tell her to do?

JOHNSON: I would try to provide a frame of reference for studying behavior--that is give a structure for studying children. If you leave it totally open-ended the teacher may fail to identify certain problems. For example in one public school study, there was an overabundance of referrals for behavior, when the children in fact, had problems in language. I would hope teachers would give attention to all basic areas of behavior, like receptive language, expressive language, reading, written language, math and social behavior.

STROTHER: Now let me ask this question. In general do you agree with Norrie that you would start with a population teacher-identified but that the difference between your position and Norrie's is that you would encourage the teacher to look a little bit more broadly beyond academic behaviors to which his approach seems to be limited.

JOHNSON: Yes, we need comments from all teachers that may be in a school, such as the art teacher, the music teacher, the phys. ed. teacher. We also need data from the parent so that we get a broader sampling of the behavior which may be deviant, which may be different.

STROTHER: Those are your differences with Norrie in step one. Once you've got this population, Norrie would pick arbitrarily some particular behaviors to start with and examine them more in detail to define it more carefully. But instead of doing that you would attempt to study this population more comprehensively in order to tease out the parameters that really differentiated them from normal children.

JOHNSON: And really look at subgroups within that population.

STROTHER: We get some problems with both of these when we go beyond it. Where would you go?

KASS: I would start with a small amount of personnel, facilities, and money. There would be a few experts who would use mainly information from developmental stages knowing what development is made up of and then studying deviations from this. Rather than starting with screening, I would start with a few situations that could be observed empirically and set these against the standard of literature and knowledge and what is known both about normal development and deviations.

STROTHER: You're talking about step two. How do you get the population that you're going to use for these studies?

KASS: Referrals to these few experts, referrals of children who are puzzling.

STROTHER: You'd use the teacher or the parent, but you'd take the more extreme end of the distribution, like cases referred by some previous screening process.

KASS: Yes.

STROTHER: Well, not let me try to press you and see where your step two differs from Doris's. She's also interested in parameters. I guess you're saying you'd take it from a developmental model.

KASS: Yes.

JOHNSON: On step two? Begin with some standardized tests to tease out other groups.

STROTHER: How would you choose the tests?

JOHNSON: First on the basis for screening for five basic symbol systems. That is get one for receptive language, expressive language, reading, written language and mathematics.

STROTHER: So you've got a cognitive model that will lead you to define your categories. And you have one that's a little bit different. It's a developmental model. This may ultimately get to the point of asking what are the kinds of models that you deal with. And that gets back to another question we started with this morning and it would require that Norrie specify a little bit more thoroughly, whether you call it model or not, the system of thinking that structures his approach to this field.

KEOGH: I'm going to beg for a bit of fantasy. I'm going to make the assumption that there are no deviant children, and I'm going to put all children into regular programs. I am going to look at teacher and instructional systems before I ever look at a child. I'd like to focus on what's happening in the situation and in the instructional strategy that the teacher uses. This approach has been proposed by my colleague, Howard Adelman. Now, I know ahead of time that not all children will be successful in a given instructional system, but I would first make a change in the instructional strategy and I wouldn't do anything to the child. I wouldn't even try to pinpoint within the child what's the matter yet. I wouldn't identify a particular group of children until I had looked rather comprehensively at what were the variables that were affecting them.

STROTHER: What would be your strategy in trying to define those? Along what dimensions would you look?

KEOGH: I suppose for one thing I'd look at the kinds of techniques the teacher uses, I think I'd look at classroom organization. I'm reminded of that beautiful description George Kelley wrote years ago about being an itinerant school psychologist in Iowa. He kept getting referrals for lazy children, and he kept looking for lazy children. As he pointed out, there are very few lazy children, but there are lots of children who don't do a school task when the teacher wants it done. Therefore, it may be teacher perception that the child is lazy, not necessarily an in-child characteristic which is at work. So Kelley began to look at teachers who referred lazy children. I think it might be interesting to pretend there are no learning disability children and to look for a while at what's happening to them in an educational program.

STROTHER: That answer surprises me. From everything you've said so far I would not have expected to hear you approach it that way.

KEOGH: Well, it comes from my own concern with the assumption of child deficit whenever there is lack of success. It seems to me that we are so tuned in to trying to find out what's the matter with you inside your head or what's the matter with me inside my head that in fact we underestimate the situational effects. You ask what would I do first? I think I would attempt to look at the learning problem in a normal frame of reference within a regular school program and I would look at teacher behavior, classroom interaction, the kind of instructional strategy used. I would make no assumptions about the characteristics of children for a while.

STROTHER: I wonder whether behind that doesn't really lie a different question than the others have addressed themselves to. It seems to me you're looking at the broader question, how do we improve our educational system.

KEOGH: I don't mean it that way. I mean it truly in the definitional sense. When a child doesn't do well in a learning task, we make the assumption that this is his problem within him. We assume that it would generalize to a whole lot of learning problems. I think it might be healthy to look at it from another point of view and say that it is indeed true that this child is not achieving or performing well in a given situation but let's try then a modification of that situation. Perhaps there's nothing the matter with him, it's that the match wasn't made properly.

STROTHER: Then is it fair to say, to put this in a comparable framework, that you're addressing yourself to question number two, given certain children I would then prefer to look at the environmental conditions that might relate to his learning problem.

KEOGH: No, I'm really saying I would identify the children in terms of the functional situation.

BRYANT: Are you saying that to get the same group of children that we were talking about as part one you would take those children who remained after you had tried to take care of the situational.

KEOGH: Exactly. I would not attempt to predetermine who those children were. My way of identifying them would be to start with the assumption that there are no children with problems and then I would go from there.

STROTHER: Excluding those whose problems were situational.

KEOGH: Yes, I would manipulate the situation first before I made any assumptions about the child.

STROTHER: So you're approaching the definition by an exclusionary clause.

KEOGH: Yes, by exclusion. And I expect by the end of the time I'd have a few kids left and then I think I would look very intensely at them. These would be Adelman's "Level 3" children, those with real in-child conditions.

STROTHER: An interesting idea. How about you?

WIEDERHOLT: I think I would follow the first two steps which you all suggested, teachers and parents behaviorally identifying the children. And the second step would be also to identify subgroups of related deficits or deficits that seemed to be common to some children. Then I would subject the subgroups to training and try to tease out or determine what the principles of individualization are related to getting achievement within these children. And I would leave it wide open as far as a conclusion. And I would not make any suppositions about what I might find. I think hopefully you might find something that would be generalizable to a subgroup in individualization of instruction.

STROTHER: Jim, what's your attack.

CHALFANT: Beginning with the present status of knowledge, like Corrine, I would take the hardcore kids, the ones with really unusual learning patterns on the basis of referral and begin with the case study approach. This would probably decide the parameters of learning. I would look at the specific behaviors they were exhibiting on these task failures and do experimental work in terms of describing behaviors more precisely. Then I would see if I could effect changes in behaviors with various kinds of interventions. Finally, I would like to construct screening devices based on the findings of the case study and move after larger numbers.

BRYANT: I think I'd start off with the teacher and possibly other referrals. I would use a system very similar to the one that Barbara was saying. I wasn't quite as concerned with the situational factors but I guess they are situational factors. What I'd want to do is to make sure that the children that were referred and the descriptions that came in along with it, that this was tested so that under more optimum conditions of a one to one or a different situation or out of the buzzing classroom kind of thing that these children were tested on learning tasks and that they did not learn. So that we could say they really were having difficulty in learning. With this group of children and with a group of statements about behaviors, I'd have an intermediate step where I'd like to get a group like this where we'd sit down and we'd take those behaviors and try to put them into a series of alternate hypotheses, i.e. how we think they might be grouped, what we think the homogeneous grouping or the dimensions are. I'd like to take that sample and I'd use the Guilford, not the Guilford model we're talking about but Guilford's method of hypothesis testing by means of analysis, to make up a series of alternate measures. So that you could say if there is such a factor or cluster of so and so, it will form up this way. If there is not it will break down in a particular way. I'd like to go back to those children, I'd like to get measurement on the children on teacher rating, on actual measurement, on any situational factors, and I'd like to see it in terms of an inverse factor analysis to get clusters or dimensions of children. And those are the things that I would try to take, again on a hypothesis-testing basis rather than the exploratory procedure usually used in factor analysis.

STROTHER: Well, let me ask a couple questions about this. I think you and Barbara are approaching it pretty much the same way. You want to define it by excluding children whose problems can be accounted for on a different basis. The difference I see is that I gather that Barbara would do so by looking at the current situation and the history of the child and that you would do so very much the way Norrie suggested, differentiating between disability and deficit by setting a learning task. Now, is this a correct statement of the difference in your approach to the problem. If it is, then I want to raise the question about efficiency.

KEOGH: No, I think I would probably do what Dale does in a practical sense of trying a child in a variety of learning situations. I think, again, I'm expressing my concern for what may be nontenable assumptions about in-child deficits or disabilities. Once those assumptions are made and made public, we all begin to see the child in those terms; perhaps he begins to act that way. My feeling would be that Norrie's step is one that comes later in the sense that he provides a way to monitor effectively the child's performance. I wouldn't predefine which child that was until I gave him a chance in a number of settings.

STROTHER: All right then, let me try this and see to what extent there's agreement on this. It seems to me implicit in what we have said here is the notion that it is important to define the population by discriminating between, and let's use the simplest formulation of it, deficiency and disability, if you can accept those terms to encompass those cases that can be accounted for on the basis of environmental factors and so forth. First, do we agree that this is the way in which we might best approach a definition of the population.

BRYANT: I'm not sure that we shouldn't also look at those that we say have deficits because we need to make a clear differentiation.

SENF: Can I just make one quick statement? I'm very pleased personally that our culture doesn't revolve around skills such as singing because I wouldn't be sitting here, I'd be being talked about. The thing that we call deficit or disability is often the product of the interaction of the skills that the child brings to the task and the task set before him. You can switch a teacher, switch a room, switch curricula, and often the new approach meets with the child's skills. I kind of wonder about those terms, disability and deficiency. They both imply child-located inadequacy and have pejorative, negative connotations where maybe you have a child who approaches a task with a distribution of internal resources discrepant to the task at hand. A clever teacher is able to redefine the task in such a way that it channels the resources of the child to the task and he never has to even face his inadequacies; indeed, he would not be inadequate.

It seems to me that there may be different ways in which information is taken in and organized such that different children, as you point out with your example of the deaf, approach tasks in different ways. They'll take information in, translate it, and be able to use it through a certain kind of mediation where some other mediation may fail. I, myself, am heavily auditory. Fortunately for my own theorizing, my wife is heavily visual. She provides me insight into a very different kind of processing than I can see in myself. We find that these underlying differences result in very different kinds of skills. She'll listen to a sequence of auditory numbers and she says she can picture them, almost as though they exist; she describes them as block-style numbers. Her memory for running auditory numbers is much better than mine because I attempt to translate them to an auditory code. I could give you other examples.

The basic point is that as your manner of information processing differs, various tasks are going to present different problems to you. It may be that as a child who is best able to process material auditorally grows older, the amount of resources that he deploys to visual information processing decreases proportionately. He gets along fine and is not deficient(or disabled) until he is required to read. All of a sudden the redistribution of processing resources from auditory to visual called for is immense; he now has to make incredible discriminations in the visual spehere that he's never had to make before. We can talk about that as a disability if we can't move it within five time samples; if we can move it, we could call it a deficiency. But, perhaps both of these terms really describe a mismatch of the child's skills with the task at hand. I don't know whether this point changes the basic dichotomy between disability and deficiency but it may suggest that we might want to take the sting off both of these words by stressing that the interaction between child abilities and task requirements is critical.

GROUP DISCUSSION

STROTHER: What I tried to do last night was review our discussions and see if there was in them any kind of implicit structure that would give us a common framework that we could use to answer some questions or at least to raise some questions. And it seemed to me there was. So what I have tried to do is to formulate that framework in a fairly systematic way and raise two sorts of questions about it: one, the research strategies that would follow from this framework, and secondly some of the questions that I think we need to address ourselves to in terms first of the extent of our agreement on the framework and secondly, on the implications it might have for the field.

I've made a major assumption that differs from the spirit of the questions in this questionnaire. That assumption is that we're interested in where the field should go from here rather than assessing the current state of the art. These questions are all phrased in terms of the present tense and my questions are really phrased in the future tense.

What I would suggest is that I outline this in general first. It won't take more than a few minutes, then we can address ourselves to the first part of it. If this doesn't seem like a fruitful way of structuring our discussion let's just throw it out and try some other way because I don't know whether this structure will fit into your cognitive styles or behavior repertoires or not. But it seemed to me that this is what we've been leading up to and I think I sensed at least a considerable degree of agreement not on some of the answers but at least on some of the ways to look for the answers.

I think that out of our discussions appear three major questions. First, how can we develop an explicit operational definition of the population of children with which we are concerned? And secondly, how can we develop a remedial technology that will efficiently modify the behavior of these children? Thirdly, how can we translate this technology into an efficient service delivery system? Now there are a number of subsidiary questions, but those are the main framework.

Turning to the first question, I'd like to begin the discussion with a few comments. I think we're all agreed and I think it's very obvious that the need for an operational definition of this population is absolutely primary. We can't do any research on which we can compare our results unless we agree on the phenomena that we're looking at. I think we've all said this many times and we've certainly said it here, that we've got to find some way of arriving at a definition. It seems to me that our discussion has suggested the following research strategy, that we should begin with children considered to have learning problems and we don't care by whom, teacher, parent, whoever. And Jerry pointed out yesterday the danger of restricting our initial population. If you pick all kids with C.N.S. damage, obviously you're going to get out kids with C.N.S. damage. So it seemed to me that we had pretty well agreed on the broadest possible initial population to draw from.

BRYANT: That would go along with Jeanne's feeling that the schools have to take. . .

STROTHER: Exactly, that we have a larger responsibility than this specific population and so we've got to attend to it in some way.

Now at this point, we can move in either one of two directions or in both directions. Either we can from this population exclude the cases attributable to other causes, and this was the point that you were making the other day, Barbara. Or we can, not concerning ourselves in particular with past history or anything like that, simply take the children and present a learning task and use some kind of a definition like Norrie's. If in five trials they don't show some kind of improvement, then these are kids with a specific learning disability. Or we could combine the two, of course. And I suspect in a practical situation that's what you would do. You'd get kids in this group that are obviously due to some other cause, you'd exclude them and then you'd use this test procedure in order to get those who don't learn.

Now if we use the test performance procedure, it seems to me that we should move toward a definition of standard conditions. If we're going to use tests or probes or defining situations or whatever for this, can we agree on what a standard set of situations might be, so that everybody wanting to select a population this way would use the same kinds of measures. This raises of course some important questions. In what areas do you want to probe and so on, and those we would have to concern ourselves with. But it seemed to me that we were reaching some agreement that we ought to try to move toward a standard set of defining conditions so that we start with the same kind of population.

Now I think at this point, I'll stop and ask this question. Are we in agreement that this method of exclusion or this process of exclusion is a way to arrive at a definition, and are we in some agreement that it might be feasible to do it in either or in some combination of these two ways or are there other ways.

CHALFANT: I find it hard to think about the process of exclusion without some sort of tests, no matter what they are. In other words, you'd almost have to begin with some kind of learning task or test of some sort. Then the question is at that point do you want to thoroughly assess everybody in your sample or do you want to start excluding on the basis of variables. You're talking about excluding through a screening procedure which would make me a bit uncomfortable. I guess I'm saying that I don't quite understand how that would be done. I'm just raising the question how do you exclude them without some sort of test, even if it's a general screen?

SENF: Your suggestion about the testing, the B part here, is more the question of the research aspect, what do you then do with them like the learning tasks and so forth. And the selection suggests that we don't do it on this total sample of mother-defined, school-defined, teacher-defined, researcher-defined LD. You use some subsample.

You suggested you would exclude some because they were due to some other cause. I don't want to haggle with it, I think perhaps you just suggested that, but there may be other reasons to exclude like color of skin, suggesting a cause but not hanging yourself on the cause. It may be that cause is so difficult to determine that there'll be other ways to break apart the sample. I think that perhaps cause is too loaded a word to use here. You exclude them on some characteristic that you can assess sufficiently reliably so that when you describe it in your method section, some other researcher could duplicate that sample that you've drawn. I think that's the critical thing, to be able to reduplicate the subsample. I think that's where we need to extend that notion of the operational definition of the population with which we'll deal into operational definitions of the subpopulations with which we'll deal so that they can be duplicated.

STROTHER: That's a good point.

JOHNSON: Just to reinforce that let us use speech therapy as an example. The speech therapist works with many subgroups. There may have several causes of stuttering such as biochemical, neurological, high aspiration, etc., but if you define a speech defect as Van Riper did it is clearer. He says a person has a disorder when the speech calls attention to itself.

KEOGH: Maybe we need to make explicit that in one sense we're talking about the programatic or remedial response to children who are having learning problems in school, serious learning problems. We say that there is a kind of responsibility or commitment to do something in a programatic sense about children who are having serious school learning problems, be these children LD, emotionally disturbed, some culturally different, whatever. We are talking also as to the more precise definition for research purposes. I am concerned at the effort to exclude children from programs because they don't fit a tight LD definiton.

STROTHER: That's an excellent point. It's on the record.

It would be impossible really to require that people agree initially on the criteria for exclusion and you make them explicit, which was your point. Given this large initial population if you drop anybody out of it, specify exactly why, then we're in no trouble.

HARING: It does appear to me that we're able to persue a reliable and valid description and that we also are able to build into this descriptive process the fact that there is change. Often just controlling conditions will introduce a way for children to begin responding in a remedial way. If we have a large number of children, some procedure to screen that regular classroom teachers might use, perhaps to screen kids and identify those that are worrisome. It would only be a beginning. The next step could be the difficult test battery, although that's kind of expensive. The final step, the step involving validity, is that step which measures the precise performance the teachers are looking for and measures it over a period of time to see if the disability does continue even though conditions have been controlled and the instructional procedures are appropriate.

STROTHER: Well, I think that takes us a step ahead, and I think this is what you were saying, by saying that if we test the ability of a child to improve within a standard period of time with standard presentations, the tests that we use here must be the things that are expected of a child in the academic situation. No other sorts of tests, these tests, these are academic tasks. Now, are we agreed on that?

JOHNSON: I'd move that down so we can see the child in many settings such as a nursery school, or a daycare center; expectancies of the people in the centers must be considered.

HARING: I have absolutely no problem with that. You're starting with children that. . .

JOHNSON: So that it's not just all academic.

HARING: Our program started with children at sixteen months.

STROTHER: Could we say then something like this: the academic expectancies or the appropriate developmental measures.

SENF: What would the service of that be? I saw this as only the definitional issue which is really very basically a starting point. Can we agree on who we'll study here? Can we agree who we wish to remediate? We have to recognize at the beginning that we do have a very heterogeneous group. The validity issue, as you point out, is in terms of some kind of tasks that we use to help us understand the child, be they commercial tests or experimental task procedures. The latter are determined by the researcher's ingenuity and are certainly not definitional.

BRYANT: I think we've moved a step beyond.

SENF: See, the validity issue adds something which I don't think. . .

STROTHER: That comes later. But the thing that leads me to hesitate a little bit, I'm not sure whether you meant that we should not use these academic tasks because these are the ultimate kind of variables we're going to use to determine validity. Were you thinking of some other kinds of tasks?

SENF: No, I just don't think that we should be specifying at this stage of the game exactly what the criterion variables should be for some validation research later on.

STROTHER: All right.

KASS: I hear different exclusions than we have formerly used in the definition and I think it may be very smart for us to do this. We used to exclude problems due to expectation, whatever the mental retardation, etc. and what I've been hearing yesterday is exclusion on the basis of what we might consider normal variation or considerations in the environment. And I'm always very troubled by screening procedures and especially teacher screening. In one sense, I feel it's a very good one. And, in another sense, I think that unless the experts, unless those who really know what is, what deviates far enough, we really haven't solved the problem of any sort of exclusion of children who could make it with some change in situation.

STROTHER: You want to consider severity and restrict the initial selection to the more. . .

KASS: What I would ask for is that the person trained in this do the screening before the screening is done by teachers across the board.

KEOGH: I don't think that is possible, Corrine, because we're getting the referral of the youngster in the program from a teacher and she says, these children are really having a terrible time.

JOHNSON: I've thought about what I said on that yesterday too, which was all teacher, and I see too many teachers that do not have the training to pick up specific kind of problems. So there are a whole group of children, for example with written language disorders, that are not always identified. Receptive language disorders are the most unidentified in the school age population. Repeatedly those children slide through because they may be pretty good, the teacher never really. . . So, some measure.

STROTHER: I hope you won't mind if I cut you off when I think the point has been made, because we've got a lot of ground to cover.

HARING: In learning disabilities and in screening, in the final pinpointing the children, we need to build in our procedures in this task that we have. Description is very much a procedure, it's not like a pinpoint identification. It involves a procedure because, unlike a Mongoloid or any other clinical type, learning disabilities is very much a function of the child as he interacts in an instructional environment. So that our procedures for identifying them must be taken into account the fact that this is an interaction.

STROTHER: Carry that a bit further. I'm not sure I follow it exactly.

HARING: As a disability comes to bear on learning, it comes to be focused more sharply as the instructional environment makes response demands on the child that are specific. The child may not even be identifiable unless we bring him into a room like this and set some cues in front of him and pinpoint the response that we expect of him.

STROTHER: Where are you leading? What's the implication of this?

HARING: The implication of this simply is what it means to idenitification. It means that identification is much more of a process over time with learning disability kids than a clinical type that can be identified visually or another type of handicap that can be identified biochemically.

BRYANT: We're talking about, coming back to Barbara's point, that we want a defined population for research. It may be used clinically later on but we want that. It makes no difference if children are missed from the school population. It would be unfortunate, but what's going to happen is that if we have a series of measures whether they are used for screening, however the initial group is funneled in, what we come out with is that here under such and such instructional conditions these children had difficulty in learning. This is our definition. I rather suspect we need an iterative process. In other words, we need a lot of accuracy at this decision point and I suspect that what this is is a sequence of measures rather than having any single measure of it.

SENF: One brief point and I think Corrine this is something that you see very differently than I do is that when one establishes who is and who is not a learning disabled child, I think a lot of people who have been in the field for quite a while have an idea in their head as to what it is. And so when people begin to be shifted into this population, you want to be sure that the appropriate experts are at the gate. And I, from a research point of view, am willing to say anybody who screams loud enough whether it's the parent, teacher, the child, or a professional is acceptable in the initial sample and then I'll worry. . .

KASS: I do too. I am willing to say that too. All I'm saying is the professional should make that decision. You've just made the decision.

STROTHER: Well I think Jerry's point, and I was about to make it too, is that you may introduce bias conscious or unconscious by using the professional. But then Doris comes back with the point that the bias may be there even if you use the teacher because she may systematically overlook certain types of problems. So I think it's clear that as long as there's selection by identification by some person there's going to be some degree of bias introduced. We can't get away from it. Now our problem is is that bias favorable to the selection of a population or, as Dale points out, is it adequate that we proceed then with a test procedure that identifies learning disabilities in specific operational terms.

BRYANT: You could even go back and you could measure your entire population with simple measures and use a process of shaping down if you wanted research that picked up all cases.

KEOGH: Could we suggest that the initial screening be broad, taking in the observations or suggestions of a number of people? I'm very reluctant to have a classroom teacher be my sole source of referral but I'm equally reluctant to have referral from a "specialist" who comes in from the outside, who may or may not really see what's happening in that classroom. What we're really saying is that the initial screening ought to select from the broadest possible set of inputs; then we'd get down at these next procedural steps of making the finer decisions.

STROTHER: I myself would not be too concerned about the introduction of bias at this point, even if it systematically excluded as Doris suggests a certain group. Because still you have a group here and you go ahead and do what I propose that we do subsequently with the group. Then you can ask did we miss somebody back there. You can always go back and search your general population.

I think that's a more efficient procedure probably than examining your initial population too exhaustively.

CHALFANT: What usually happens in practice is that people will ask for referrals right away and a certain number of names will be identified in early September which introduces the teacher bias. Then the professional approaches the problem with some sort of screening device and follows that up and inevitably identifies the kids that the teacher does not identify which introduces the professional bias. If we have both biases operating, we might as well use both procedures and that way you have the largest population.

STROTHER: Have we spent enough time on this? All right, let's move ahead.

BRYANT: There is another point that is a little different that I think really relates to this and it came back to a question that Norris asked earlier. He said if a child had encoding and decoding difficulties what would he be. It seems to me that we're faced with a factor that if a child comes in and on those measures he has learning disability, then we need to identify him as learning disability. Other elements of exclusion I think have to be built in separately and explicitly or we have to deal with them in terms of this.

STROTHER: I think we're agreed on that point, Dale.

CHALFANT: I'm not sure if you're leaving this question of the academic tasks, because I think you stated my view when you were talking to Jerry. It might be your baseline and your terminal behavior, but there are other things that I would see that would not be academic type tasks.

STROTHER: Such as?

CHALFANT: Some of the processing things which do not relate directly to reading, writing, arithmetic, or language.

STROTHER: If you don't mind, let me go one step further because I think it's that step that will take in what you're concerned about.

Having selected this population, what we would need to do now of course is to define the developmental measures or the academic measures that we're going to apply to this population. Then we're going to carry our observations over a restricted period of time and given normal opportunity for improvement select out those that don't show improvement. Are we agreed that this would be a good strategy. All right, now suppose we've done this. Now we've narrowed this down to this kind of a population.

Then our next task is to determine the characteristics of this specific population. And here we may part. I'm going to present here the alternatives that I think I've heard the last few days and see how many of us subscribe to which or whether they're all compatible. This population might be described as Norris has suggested in terms of the precise academic responses that they're now making, and that might be considered a sufficient description.

BRYANT: Academic responses that they're now making on these measures, the learning tests?

STROTHER: Would you say on these measures, Norrie, or would you want to add other measures?

HARING: I would say a comprehensive assessment of performance on academic responses which would, by the way, include the use of academic skills to acquire information.

BRYANT: But you're talking about on specific measures, not on history or things than come in externally.

JOHNSON: Task versus test.

HARING: It goes up to the systematic application of academic skills to acquire information.

STROTHER: That leads to a question that I think Dale is asking and I think we need to be more explicit. It's clear how you do that with respect to elementary sorts of skills, but I think you're asking the question can you apply this strategy to more complex skills.

BRYANT: I was actually asking a different question. I was saying we're ignoring information that we get from the teacher or from anything else. The definition of academic responses is on the learning tasks that we are using, okay.

STROTHER: Well, now how would you respond to my question, Norrie. When you asked me what I would consider a more complex skill, I suppose the ability to comprehend an abstract concept.

HARING: Yes, as would be assessed by a button press or by writing a response.

KEOGH: That's where we might disagree as to how it might be assessed. I think there might be some other ways to do it.

HARING: Orally, button press, or written response. In other words, I won't accept a wise look on the face.

STROTHER: Okay. At this point, if we were as a group going to plan this research, it would be Norrie's responsibility and he would be willing to assume it and feels confident that it can be done, to define the kinds of academic responses that would be needed to determine the characteristics of this population.

That's what he would do and then we could agree or disagree or supplement that, but at least we'd have a starting point that we could shoot at. I don't think we can afford to take time now to go into that aspect of it, although I think it's clear how we could go into it.

CHALFANT: For example, a child who can't read is referred by the teacher. Would a failure on sound blending or phonic tasks be examples of your academic responses?

HARING: Exactly.

JOHNSON: Or would it be a reading achievement test.

HARING: A high response rate of error if it persisted.

CHALFANT: Rather than an achievement test.

HARING: That's a step further.

STROTHER: That was a very interesting question, Jim, that throws open a whole new issue because you're now asking would you define as academic tasks the thing that I look at as processes. How much difference of opinion is there on behaviors with respect to academic tasks or processes. That's really a fundamental question.

HARING: I have no problem with that whatsoever.

STROTHER: So there may not be as much difference as we anticipate from the language.

BRYANT: I think rather than taking a subskill that is essential, the crucial thing would be for example learning sight words, learning a certain sound association, an actual learning task because there are a variety of ways that children might learn.

STROTHER: But the point is, Dale, we have decided we have agreed that we are going to select this population on the basis of these learning tasks. Now we've gone a step beyond that and we're asking what are the finer grained analyses of their problems. We're into characteristics.

SENF: I think it's very important to discriminate what is something that a field agrees on as the context of their study from various methods or strategies of doing research. What we're talking about now is the way Norrie thinks that we'll best advance knowledge. I don't take that approach but I sure want him to do it. I don't think we can decide as a group what is the best way to go about basic research. I think, we're now talking about alternatives research approaches to the target population.

STROTHER: I have suggested this as the first alternative. We don't have to buy this, no, that's right. And we're pushing this to see how much difference there is really in our conception even of this alternative, whether we approach it from a behavioral or a cognitive point of .view.

BRYANT: But if you're doing basic process research, we still need to know what you mean by learning disabilities and it seems to me that the characteristics are still a part not of the selection but of the definition.

STROTHER: Let me go ahead with these other alternatives and maybe they'll get at these questions that you're both raising.

HARING: There's one point I think is important here and that is when it comes to the response end of this, we are all very much alike because we have this area in which we're both looking at responses even though you're approaching it from a cognitive versus a behavioral field. There is this area which we both come together on, that's where the child is responding.

STROTHER: But then we got other inferences or implications that we don't share.

KEOGH: I think that would follow Jerry's point that we do not want to restrict it into particular measures or procedures at this time.

STROTHER: All right, now let's go on. We can always come back if we need to but let's see where this leads to.

What the task is here is to determine the characteristics of this specific population and the first alternative is to do this in terms of a precise description of their academic responses. Now the second alternative would be to describe them in terms of a profile of their cognitive abilities and disabilities. And if we attempt to do that, then we've got to define the cognitive model that we're using or at least the dimensions of the cognitive processes that we're going to use for the description. But the essence of this is really a profile of cognitive abilities and disabilities. Now does anybody have trouble with that as an alternative approach to definition. Is there a better way of stating it?

SENF: I almost see it no longer as a statement of definition anymore. I see definition in a very logical positivist sense, that you simply say this is my domain of study and you know nothing about it yet. These things now we're talking about are ways in which we can imbue this group of children with some kind of meaning, some kind of understanding we can have of them. So I don't see it as definitional.

STROTHER: Well I didn't intend it to be definitional. The definitional step, you see, we've already achieved. We've selected our precise population, now we're trying to give meaning to that in terms of ways in which we can understand it either in terms of academic responses or a profile of abilities and disabilities.

BRYANT: It's quite possible however that if Norrie's working on a particular kind of study working with a precise description of academic responses that if there was a description in terms of cognitive abilities and disabilities just as if you were describing socioeconomic or something else, it would allow his results to be interpreted by the individuals who are focusing on a cognitive profile.

STROTHER: You're suggesting we could combine the two and this would add. . .

BRYANT: Yes, not combine as a means of study but that we might say that it would be very helpful if people in the field gave certain minimum information, even if it wasn't essential to their own particular study. It would be a better description of population.

STROTHER: All right, I think that point's clear.

CHALFANT: I think I may not be following conceptually. If we began with a large number of children, is this our research population?

STROTHER: Simply our initial population. Then we narrow that down, you see, by test procedures that we agreed on. Now this is the population that we're studying and our question is now how to proceed to understand this specific population.

Well, let me go one more step ahead and then we can take all three, because I was suggesting three alternatives here: either the precise definition of academic responses, or a profile of cognitive abilities or disabilities, and then this third one is a point which I think both Doris and Jeanne brought up, that we should add to this description not just the cognitive abilities and disabilities but the affective, motivational, demographic, and perhaps other characteristics of this population. In other words, not restrict our concern simply to their academic characteristics.

CHALFANT: Could we add the situational and environmental factors as well?

STROTHER: That's a good point, because that came out very clearly yesterday when we were trying to give our immediate responses, I think two or three people. . .

CHALFANT: In describing precise academic responses, there is the response the child emits as he's doing the task. You could call the product of his work an academic response, I suppose, or you could call the procedure, the sequence of events that he goes through producing that product. I was wondering what Norrie's definition of this would be because that's how I would look at it. Procedure and product would both be examples of academic response.

HARING: An example, say sounds. We know that in order to attack words, in order to decode words, say sounds should be about 60 a minute correct or otherwise we run into some problems.

STROTHER: What about what Hull would call the consumatory response--the last in the chain--the thing that is overt.

HARING: It doesn't explain all the processes that are going on, it's only a summation. . .

CHALFANT: No, not the processes, the procedure. For example, handwriting, I could study a kid's handwriting. . .

HARING: As a procedure, we're using a definition of correct, a definition of error, and then rate.

CHALFANT: How about the way he writes it.

HARING: Those aspects would go into the definition of correct or error.

CHALFANT: Okay, that's what I'm asking. Both those elements would be in your analysis. How he does it and what he did.

HARING: You get a great deal from the errors.

JOHNSON: And assumptions are already being made that a child has to do that in order to learn to read.

HARING: In order to decode the word.

STROTHER: Well now, the question I'm asking here, we've suggested three alternative approaches to the definition of these characteristics. I'm not asking which is best or which would you choose, but do these represent the various different approaches that might be used. Which one is selected depends on the investigator but he has the responsibility of defining the components of his approach.

WIEDERHOLT: T[illegible] is not really an alternative, is it? Aren't you adding it to one and two [illegible]

STROTHER: That's correct, yes. You'd have two alternatives and two versions of the second.

CHALFANT: There are researchers who are very much interested in etiological, and neurophysiological correlates. Although I'm not going to look at brains, some people might. Do you want to include that as well?

KEOGH: I think there'd better be a category that allows for some other kinds of parameters but doesn't specify what they have to be. The point is that they're being specified.

SENF: What is the function of this delineation? Why are we trying to make this delineation?

STROTHER: All right, that's an important question. Let's just pursue it for a moment. He raises the question of why are we attempting to make this delineation and what he's doing is referring back to the point that he made the other day that there are infinite ways in which you can classify or categorize or describe people and you've got to agree on what kind of a description is pertinent to your immediate objectives. Let's consider here, and this will narrow our discussion, let's consider that our concern here is with treatment and not with etiology, that we're looking at things that are relevant to treatment. We can add what would be necessary to approach etiology later, but I think if we focus on treatment that it'll sharpen our analysis.

CHALFANT: I'd like to play devil's advocate. The need for drugs is a form of treatment. There are some medical interventions. I don't like to push the point, but there are researchers interested in medical intervention. If research money eventually becomes available based on things that come out of this institute, then I think this we should not omit related areas of interest.

STROTHER: You're quite right. But you see then that opens the door to anything that can conceivably be related to treatment and you're. . .

CHALFANT: How do you define treatment?

STROTHER: Anything, any intervention that will modify the behavior.

CHALFANT: I'm arguing for a small group of researchers and I'm trying to say what they would say if they were here. We are educators, basically, and we're limiting this to academic things, the psychologists are represented, and so are those who are interested in emotional behaviors. I'm just wondering if there are not relevant characteristics that can be measured in the physical world. What is our rationale for not including that as well, particularly if physical characteristics helps describe these children accurately and leads to treatment?

BRYANT: You're saying that you can define a child by saying that the administration of this drug causes him to behave in a different way.

CHALFANT: No, I'm saying that it may be in the future that the medical group will come up with some characteristics through tests which will help identify this population. They may develop certain drugs or forms of intervention in the form of treatment. And I'm saying that our bias is operating, that we are focusing on educational definition. What is our rationale for excluding other areas?

STROTHER: Would you be willing to take this as a test case, differentiating what you're concerned about and what you have been concerned about. Suppose you examine a child and you find by chromosomal analysis a translocation. That I would say we would not be interested in because it has no implications for treatment. It has implications for prevention and if we're interested in prevention we would be interested in pursuing the issue. On the other hand, suppose we find a P.K.U. case. That we would be interested in because this condition does have implications for treatment. Our concern is how we change the behavior of this population of children by whatever means it's necessary to use to change them, be they educational or biochemical or surgical or whatever.

KEOGH: It seems to me that we're saying we start with a group of youngsters who have serious learning problems in the school setting. We then ask for what is a complete description in terms of the demographic characteristics, situational influences, and so forth. Then we say to the research person, make clear now the point from which you select, i.e., specify the parameters you're using. These could very well be for the medical research person something which had some neurophysiological basis. For you, it would be something else; for Norrie, it would be something else. I suppose you could use all of them if you took a very very particular group.

JOHNSON: There's one other ultimate implication and that is in terms of professional preparation.

STROTHER: Let's leave that till later.

JOHNSON: But it relates to this.

STROTHER: You're quite right, it does. And it relates to your service delivery system too and so we'll get to those later.

SENF: I see a redefinition in terms of a very inclusive definition really as a starting point. We shouldn't make exclusions based on whether you can or cannot treat, not on race, or any other guessed at etiology. By omitting poor children for example, we affirm a priori that their poverty caused their disability and, hence, we say we can't help them or study their problems. Though we recognize the illogic of claiming that so many minority group children have neurological defects, we accept the illogic that a poor child can't have a specific learning disability. By taking an inclusive definition to start with, you can then take upon yourself the task of generating an adequate set of statements which give you an understanding of the field. Now then, you could use those for training people, you could use them for remedial purposes, you could use them for just about anything you want. But, I think the problem that we're ducking here is that we really cannot determine by rational discussion what a researcher need do to describe that sample. For example, how does a neurologist describe his sample? It was assembled through a sociological network of referrals. He doesn't have any idea whatsoever what the relationship of his sample is to the one that you do your research on in a special education installation. That's the difficulty we face and that's where research is going to break down unless we can specify the child's characteristics empirically; our consensus is just not sufficient.

STROTHER: Don't determine it a priori. I think you're quite right. All right, have we gone far enough on this to bring out all the points everybody thinks need to be brought out?

Then I want to move a step ahead. And our next step given this population and the information we've accumulated about it by whichever of these approaches we propose to use, we have agreed I think that having gone through these steps we would have a heterogeneous group.

Can we now then proceed to identify homogeneous subgroups within this population, either in terms of tasks and this is what a conventional factor analysis would lead us to, or in terms of similarities among children which is what an inverse factor analysis would lead to. And the question is what are the differences between the groupings which would result. An interesting question, but we don't need to get into it here. Now do we agree that this population would be heterogeneous; that it would be useful to try to divide it into more homogeneous subcategories; and that the ways in which you might do so are quite traditional methods.

BRYANT: I think it would be heterogeneous, but we have already made a step toward homogeneous because when we have taken the initial learning tests, we've been able to say that the child doesn't have trouble on this learning but does have trouble on this learning. So we have a crude separation just on the basis of our initial tests.

STROTHER: Yes, that's right. But I think we all feel we'd need to go further than that, that this would still be too diverse a population. Is that the case? If it isn't, let's take exception to it.

JOHNSON: The subgroups at this level, then would be those with interaction or poor instruction?

STROTHER: Those would be out already.

JOHNSON: Not if we were to accept alternative three.

STROTHER: You see, what we have done it seems to me is this. We've started with a large population of kids who are considered to have learning difficulties; then we have excluded those cases that are due to clearly identifiable causes. Then we have tested and defined a still more specific population in terms of their inability to improve on certain specified learning tasks. Then given this population, we're simply asking what are their characteristics.

SENF: I don't follow that as the trend of the discussion at all.

STROTHER: Let me go back, because I think this is very important, in terms of steps. Our first step has been to ask teachers or others, including experts if you want, to define children simply in terms of the fact that they have a learning problem, a severe learning problem.

SENF: Select more than define?

STROTHER: Yes, select them. This is the group that we're going to take a look at. Then given that group, we proceed to exclude some people from it.

SENF: On what basis? Why would you want to do that? For what purpose would you now want to . . .

STROTHER: The purpose would be to get a more precise definition, because in this group you're going to have mentally retarded, and the emotionally disturbed, and whole gamut of kids who are having learning problems for any reason whatsoever. Now we could say I want to concern myself with this total population but I thought that our discussion here was directed toward a more precise population.

SENF: I think right there it's a question that as a researcher one might do something different than one who is concerned about the professional integrity of a field. If you're interested as a person associating himself with a field called Learning Disabilities, further subdivision may become a critical issue for you. As a research psychologist, I say that distinction now doesn't matter. Now I don't happen to be as interested in something called mental deficiency and so I'm willing to operationalize this disorder in terms of an IQ score and drop these children from my population. I'm not so sure one can as readily or as equally desirably drop the emotionally disturbed, sensorially impaired, culturally disadvanted, and improperly taught. You see, I prefer to break up the whole population of failing youngsters empirically for further study rather than to eliminate a large portion of them at the outset on guessed-at etiology. After all, they all need help and none of them go away. Why define the field so exclusively? There are, of course, legislative-administrative reasons.

STROTHER: I thought we had agreed that by identifying this broad population first we had accepted responsibility for it and considered that it was legitimate to study it, and provide facilities and programs for all children with learning difficulties but that our discussion here was concerned not with this total population but with a subpopulation of some sort. Now does that differ from your. . .

SENF: Only in the sense that I see that some people here may be interested in different aspects of the total population. But the exclusion suggests that we now refine it by throwing people out to get some subset that we all would be interested in. And I think as you throw out children you throw out some of our interests.

CHALFANT: I think the question is when do we introduce the exclusion factor and what is the basis for that exclusion factor.

STROTHER: Well, can we agree on this. Maybe this is our least common denominator. That if we start with a population simply identified as having learning difficulties, if we proceed then to study any less than this total population, we state explicitly what children we're excluding.

KASS: Or what children we're including. Or do you think we're not up to that yet.

STROTHER: We've already given the inclusive definition by saying we'll pick any child who has a learning problem.

KASS: Well then, aren't we going through a series of descriptions.

JOHNSON: And are altering the sequence we typically use.

BRYANT: To take a sticky point. For example, one researcher might say I'm not going to take disadvantaged children as defined by so and so. But we don't want to specify that he can't, so that we might end up with someone taking a kid with an IQ of 76 whereas another investigator would leave off a kid with an IQ of 76.

KASS: My point on a series of inclusions. . . You see, it might be easier for me to describe the subpopulation that I'm choosing to study than for me to tell about all the exclusions that I'm making about the broader population.

STROTHER: All right. That's an alternative, that is if you can state explicitly the criteria for including or state explicitly the criteria for exclusion. That's perfectly acceptable.

KEOGH: I am still bothered as I think of what may happen when somebody else looks at this discussion. I think the research definition is going to become confused with operational implications in terms of programs. I want to be very sure that we talk of this in terms of selection of research samples.

STROTHER: I don't quite follow you, go a little bit further.

KEOGH: Although we say at the beginning that we're talking about research, that may be forgotten. The next question is going to be, well, we can't handle in our program this many kids, 20% of the population or five percent of the population. So the definition gets thrown out for the wrong reasons.

STROTHER: Or we can't afford to fund from the funds earmarked for specific learning disabilities that large a population. That's a very important administrative point.

I'm very glad the question came up because I don't think we ought to move ahead and gloss over differences that are important or points that are significant. But I think what we've been saying here really is that, when among the group of children who have any kind of learning disabilities you select a subgroup, it is your responsibility to specify very explicitly either the criteria for exclusion or the criteria for inclusion to the point that this population can be replicated.

HARING: And at this point, it would be more practical for me to use rather than some of the exclusion variables that have been mentioned such as emotional disturbance, mental retardation, it's more practical for me and I do in fact use severity of response deficit and chronicity of response deficit.

SENF: Could we add to this not only the statement that this is critically important but that one of the roadblocks to our advancement is our lack of methods to do this task of inclusion or exclusion. Norrie, you could publish and otherwise advocate your manner of doing it with rational arguments as to why your method was best and I might stress that a category system based on empirical factors and cluster analysis is best and would try to convince researchers to do it my way. The point is we want people to attend to this issue very carefully and come up with some ways of doing it so that we can move ahead.

STROTHER: Good.

CHALFANT: Conferences and institutes on this as well.

STROTHER: Let me put that in a little bit more general terms, if I may. I think this ought to appear in black print in the record, that from this agreement it follows that we should encourage the publication of descriptions of methods for doing this, we should insist that every editor deny publication to an article that doesn't meet these criteria, we should put pressure on every program chairman not to accept a paper unless the population meets these criteria.

JOHNSON: And another clause, the programs in school state that the criteria should be specified.

STROTHER: Well we'll have to come to that.

KEOGH: That's beautiful, I like that. Here are some very specific implications.

CHALFANT: This is precisely what every public school program has to do anyway in selecting their population for service.

STROTHER: All right, now then, we're on the point of identifying homogeneous subgroups and however we proceed to do that it seems to me that there are two questions that follow from that. One is to what extent do these different approaches lead to different groupings, or regardless of approach do we all arrive at essentially the same groupings. And secondly, which system of classification is most relevant to efficient remediation, and this was the point you raised the other day, Jim.

JOHNSON: That's a very good question.

SENF: And those are empirical questions.

STROTHER: Strictly empirical. Well now, with that I've covered everything that I had listed here under defining the population and studying their characteristics. And I would now move ahead to question number two about developing a remedial technology that will efficiently modify the behavior of these children. But let's stop at this point.

SENF: I like the way you said it that time as opposed to previously. The first time you didn't say in addition to a definition "studying their characteristics" We should get that in there too, a study of the children's characteristics.

STROTHER: Let the record note that.

KASS: May I just insert, going back to Jerry's comment previously that we may differ on the first question of the broad population and the point I made about the professional person being very much concerned. I agree with the group on this procedure but I would like to point up that, following this second step of identifying homogeneous subgroups, I would like for the professionals to look back at number one again and communicate a better definition, so that we can each time insert that for consideration. It may come from a sequence, but we're left with the first question of definition for so long because we never feed back into the original question.

CHALFANT: Our third large question would possibly cover that, the delivery system.

STROTHER: Yes, it's possible. Let's keep it in mind. Now just as a suggestion to the editor, it seems to me if we read the transcript and any of us wants to supplement or differ or take exception to any points, then this might well be included in the final record.

Well now, if you want to go ahead this way, then I would turn to this question of how do we develop a remedial technology that will efficiently modify the behavior of these children.

HARING: If you've approached it from the standpoint that you have, identified the deficits and the areas of the deficits, then from this point of view (and from this point of view only and it might only be for your baseline to elaborate and develop more elaborate remediation procedures) it is necessary to know the rate or the criteria as seen by a population of learners that are successful. It is necessary to have that information. I want to stress that because I think Jerry felt from some of the remarks he made the day before yesterday that we didn't believe that was important. But it is essential so that we can determine a criterion of correct. We use rate because it's sensitive, so rate of correct, say sounds or say letters, that is necessary for successful performance as defined by the child being able to compete with these children. We use median rates for groups of kids in regular classrooms, that's where we get our statistics. Then it is important next to arrange the cues so that very few errors, or fewer and fewer errors, are being made by the child. Next important to measure, at least probe and sample regularly. . .

STROTHER: Excuse me, you're outlining as an approach to remediation.

HARING: A strategy which involves a systematic approach. I'm just laying this on you as baseline and you proceed from there. And then finally assessment of performance to determine criterion performance.

STROTHER: Well, I think I'm saying the same things here, but I wonder if we can go through it step by step because I think you missed one step that we discussed earlier I felt we had reached some agreement on the point and I think it was omitted from what you just said.

If we are going to approach the development of a remedial technology, then step number one would be to specify the rationale on which the proposed technology is based. And we got into this when we talked about models as a systematic procedure and we pointed out that we have to proceed in a nonrandom fashion and therefore it's our responsibility to describe what that nonrandom fashion is, whether we call it a model or whatever we call it.

BRYANT: With the addition that if it is an empirical finding, somebody's discovered that if you get a person to comb their hair in a given way, it seems to help them do so and so, then they ought to specify. So that it doesn't have to be a theoretical model, a theoretical rationale, but it needs to be specified.

STROTHER: It can be anything--for example, I had a dream last night that this was the way to do it, I did it this way, and it worked.

JOHNSON: Do you include in the word rationale, goals. Because the goal that the remedial person establishes is based on his frame of reference.

STROTHER: It would be implicit in that.

BRYANT: Would it be better to make that a one and make the rationale two. In other words, to specify.

JOHNSON: I may not think it's important to learn the letter sounds.

STROTHER: All right, that's a good point.

KASS: The plural technologies might just be taken as a sort of synonym for techniques. I'm thinking of technology in the sense of the word of knowledge; as a body of knowledge or bodies of knowledge.

STROTHER: I think we'll come to that in just a minute. If we don't, let's come back to it.

HARING: Well, my rationale is based strictly on continuous assessment of performance and that the pinpoint. . .

JOHNSON: But you're concerned over whether academic goals are important, whether social goals are important, etc.

WIEDERHOLT: Then do we want goals instead of rationale.

STROTHER: All we're saying here really is that it's incumbent upon the researcher to state why he's doing what he's doing.

JOHNSON: Which certainly has been a part of what we've seen in remediation over the years. We do need to know if children go up in visual perception, whether that's part of their goal. . .

BRYANT: That's frequently overlooked. They want to increase on visual perception because of something else, so that there the rationale becomes quite crucial. It's also left out in other cases.

STROTHER: Well, this is an important point.I think it's worth stressing because it has confused research on psychotherapy, since you may have many different goals in psychotheraphy. Unless you specify your goal, you don't have a fair measure of the effectiveness of the method. So it's important.

JOHNSON: I like that whole word technology.

KEOGH: Yes, we want to be sure that technology as a generic term couldn't be confused with a specific technique.

HARING: It's got a nice basis. It means the application of scientific information.

KEOGH: I would argue vigorously against a single technique; I would agree that there is a technology.

CHALFANT: We have a rationale, first step.

STROTHER: Then our second step would be to specify (and here I have difficulty finding a sufficiently general term) the procedures or the tasks or maybe come back to technology to be used in terms of the curriculum, i.e. the materials and sequences that we're going to present to the child, the instructional method, the setting, and perhaps other parameters. And this is only saying we describe explicitly our interventions in terms of all the aspects of intervention that are pertinent.

JOHNSON: Then might we also say that in number one, along with specifying goals and rationale, there also would be the "test battery" formal or informal that was used in establishing those goals.

STROTHER: I don't follow, Doris.

JOHNSON: In specifying the goals one would also include a statement of rationale. The rationale may be derived from a psychoneurological framework, or a process orientation. One needs to know the frame of reference with regard to a battery of achievement tests, or process tests.

STROTHER: Are you thinking of these as independent variables or as dependent variables or where do they enter in to the. . .

JOHNSON: I think they enter into that rationale maybe as a secondary step.

SENF: Are you saying that given a certain frameowrk, you are prone to measure variables in certain ways? Because of Norrie's orientation he goes to very specific assessment from which he can derive rate measures where someone with a different orientation will take the Wide Range Achievement Test.

JOHNSON: If I wanted to use Norrie's procedures I would have to know the frame of reference or theory before using the procedures.

SENF: Well, that's to encourage people to have a methods section which really describes what they've done. It should be the biggest part of any research article, whether reporting basic research or the evaluation of a remedial program.

STROTHER: And that's exactly what we're talking about here, methods.

JOHNSON: I just didn't hear that term included in those et ceteras.

CHALFANT: I have a procedural suggestion and then a comment based on what you've said. One strategy we might employ to move us ahead would be to have you outline these things and then we could go through and raise questions because I've got something that might take some time.

STROTHER: I don't have far to go on this one. We've specified the rationale, we've specified the methods that we're using, and then we've got to proceed to the obvious thing and that is to measure the changes precisely. But I want to add this, measure them precisely in terms of changes on specific tasks, changes on similar tasks, changes on dissimilar tasks, and changes over a reasonably long period of time. Adequate criterion measure must do all of these things. We're asking the question how much does this procedure generalize.

JOHNSON: This gets at the visual perception and reading.

STROTHER: This we discussed several times in various ways. But it's very interesting that it's not been considered in most articles. They've contented themselves with one of these types of measures and thought that was a sufficient measure. What I'm trying to imply here is that a sufficient measure measures along all these dimensions.

KEOGH: Are you really suggesting, Charles, that this is a kind of a plan for testing program efficacy.

STROTHER: Yes, oh yes, exactly. I'm directing this strictly toward the development of a remedial technology. Anything else you want to do is in addition to that or apart from it.

JOHNSON: Could I add another variable? We need to look at various contexts. It is not enough for the child to read in a one to one situation, but in the classroom and other environments.

STROTHER: I meant to include that in similar and dissimilar tasks, somewhere along that dimension.

SENF: How strongly do you wish these to be read into the record? Is it more a statement that in the best of all possible worlds all of this should be satisfied but that we'll recognize that at times costs or the need to get something published to allow other investigators to react to it may not permit one to wait for a two-year follow up.

STROTHER: Oh, of course that, yes. But I would like to put it this way and see if you would agree with it. That, in the presentation of evidence of the effectiveness of the intervention, that it's the responsibility of the investigator to concern himself with and state explicitly what his measures are in terms of the tasks on which the child has been tested and/or on what he conceives to be a similar task. It is perfectly satisfactory to me for him to limit himself to any one of these. But it's his responsibility to consider outcome measures; to state these he has used as explicitly as he can and to recognize the validity of these other measures. So if somebody demonstrates that your technique by these other measures is not adequate, you recognize that as a valid criticism. This is all I'm saying.

CHALFANT: In training teachers, we want them to have a rationale to work with a child,write their procedures and measure changes to see if what they've done has been effective. This is basically the format of our lesson plan. Now there is another element in our lesson plan that is not here, and this is probably implied somewhere. Teachers must have a rationale for what they are going to do and state very explicitly what their instructional objectives are in terms of the terminal behavior.

STROTHER: That was the point that Doris brought up. Except that we agreed to include it under number one.

JOHNSON: Specify goals.

STROTHER: Yes, we agreed it was essential that we put it there. Does that seem. . .

CHALFANT: That's fine.

STROTHER: Then I have just one other step to suggest here. That after we have done this then, and this comes back to your point Barbara, we need to demonstrate the relative efficiency of this technology by comparing it with other technologies on similar populations.

HARING: Since this is almost step by step consistent with the procedures that we would follow, I would expect at this point to hear quite a bit of disagreement here.

STROTHER: All right, is there? I think this is probably a general statement in which we can all fit our. . .

KEOGH: You might look at rate and somebody else would look at something else but the fact is that it's been specified.

JOHNSON: And one of us might look at teaching the child to read, another to sequence, and another to blend. And what we have to find out is who attains goals the fastest.

KASS: We're comparing this technology with another technology?

STROTHER: With other technologies.

I think what we're trying to reach here is a fairly explicit formulation of an acceptable scientific procedure and make it sufficiently explicit so that we can say, sure what I do fits into that framework in this way. We all agree that these are the appropriate criteria to be used and these are the responsibilities of the researcher. And if we agree on that, then we can talk about the relative effectiveness of our technologies.

BRYANT: Now when we speak of relative efficiency of technologies, we go back to the fact that we have defined some homogeneous subgroups, so relative is also, is this more effective for this subgroup than it is for another subgroup.

STROTHER: All right, then we're through with this section, Jim. If there's a point you want to raise, let's come back and take a look if there's anything else that we need to put into this approach to the development of a remedial technology.

HARING: I'd like to speak to the question of efficiency. Efficiency in the sense of a technology or looking at technologies depends on how soon you can get the results of an applied treatment and make decisions about that and make a refinement. If one looks at the broad technology, you really have to come to grips with how often you measure. And a lot of the traditional measures, measurement points that are built in into most of the designs we inherited from educational psychology, have led us to sort of pre and post test measurement frequencies and usually pre-post test designs do not call for measures much more than six weeks at the best. A lot of the kinds of treatments that we use don't pay off in six weeks if we're going to use analysis of variance or a t test. So that the application of experimental analysis even though one is using one subject at a time offers especially for that child an efficient approach or strategy of answering the question what works best fastest, which is efficiency.

SENF: Isn't there a cost factor implicit in the word efficiency? If you mobilize a whole state's resources to treat one child, you may be able to do it in six months, but somebody would argue that that's not very efficient.

STROTHER: He's talking in terms of a cost benefit analysis.

HARING: You wouldn't need to treat one child in that time. This is then a matter of again another technology and that's the scheduling and grouping technology. Technology and strategy, well, I'm going to stick with strategy for a moment and allow you to abstract out of that strategy the technologies you need to make the thing work for you. But the strategy involves simply that measurement of one child at a time continuously while you refine a procedure that's most effective, most efficient for that child. And there's no either-or efficiency as far as cost is concerned because we can do that in a group.

STROTHER: You made the point the other day Norrie too, and I think this is just a modification of what you're now saying, that you started out with a completely continuous measure and you found that that yielded too large a quantity of data. So now on a cost benefit basis you're going to a question of sampling, asking what is the smallest number of samples I can take to yield the amount of information that will enable me to modify the behavior of this child most effectively. And this is the point you're making.

KEOGH: The quarrel I have here is that it seems to me we're making the method the goal and I don't think that's the way it ought to be, i.e., maybe you're right that you can do it with noncontinuous sampling, I think that's great, it's an efficient kind of thing. But the question is what am I going to sample noncontinuously? It's here that we would have some differences. I would be very reluctant to have the methodology get tied up with the content of what's being assessed or what we're trying to change.

HARING: My response here is in the sake of looking at efficiency, and efficiency comes out of a clear specification of what you are looking at.

KEOGH: But if we look at only the things, perhaps the more limited behaviors which are easily specifiable, we don't address ourselves to larger questions.

HARING: That would be your concern, Barbara, and you'd want to outline that so that you listed the specificities that you wanted to include. Then I'd have no problem with that. I'd only have a problem with that if you couldn't measure your specificities.

CHALFANT: You used a word just a minute ago that hasn't been used yet and that doesn't appear in stage four and that is effectiveness. We can be very efficient but highly ineffective. Also we can be highly effective but very inefficient.

STROTHER: I meant to imply that, but let's make it explicit.

CHALFANT: If we said relative efficiency and effectiveness. We trade one for the other in both cases.

HARING: I don't need to repeat, but as a strategy that we begin to hold up other strategies against, I'm recommending that the most efficient sampling procedure is taken continuously and used to assess the effectiveness of the technologies you're using. That's what I'm suggesting at this point. I'm not recommending any technologies but I'm asking only that we use the most efficient measurement procedure, and I've outlined one, to assess the effectiveness of the technologies. So it's kind of an introduction to a procedure.

STROTHER: Well, those were the only points that I'd included here. If there's nothing to add, I'd like to move ahead.

JOHNSON: Could I add just one minor detail? It may be included under methodology but I think it does make some difference when we look at the community and the resources available to the child and should perhaps also state the nature of the population and the community from which it's drawn. A daycare center and Montesorri nursery school may see the child quite differently.

STROTHER: Are you raising here the issue of feasibility? I hadn't realized it before you raised this question but we've been talking here about measuring the efficiency and effectiveness in a given setting. Now you're asking the question about the transferrability to other settings and the necessity perhaps of modifying it in terms of the reality of the other setting. That's an extremely important point, Doris, and it skipped me entirely.

JOHNSON: We watch it as a child goes from a highly structured school into a less structured junior high, and he may have many problems.

CHALFANT: We could probably be more explicit in what we mean by rationale, what variables are we talking about?

STROTHER: Well, unless there are other points, let's move ahead because I think we're going to come to some things now that we haven't really discussed sufficiently and we may need to discuss.

The third major area is this area of how do we translate this technology into an efficient service delivery system. While this question has been raised by two or three of us, we've not really gone into it. It introduces a lot of things that I don't think we have time to go into now. So, if you agree, I'd like simply to state it as the next logical question and then to dismiss it because there are some other things here that I think are related to the context of our discussion on which we can reach a resolution in a reasonable time.

These are subsidiary questions and they don't necessarily follow from what we've already talked about. The two questions I'd like to raise are this: if we agree that this general research strategy should be adopted, how can we proceed to influence the granting agencies, the investigators, students, journals, program chairmen, and so on to accept this general research strategy. And my next question would be what implications does this strategy have for training both at the present time in terms of what we now know and ultimately as we gather more information through the use of this strategy, and what implications does it have for service delivery.

WIEDERHOLT: Dr. Strother, could I go back a minute to this question of translate technology into efficient delivery systems. Part of our final report will deal with delivery systems and I was wondering if. . . we would hate to lose out on your input into this section also, and while you don't have to attend to it today, I wonder if it would be possible if you could talk about some way of getting information to us on how you feel about this as a group.

STROTHER: Well, my perception was that Jeanne's paper dealt with this to a very considerable extent, I think Doris touched on it and Corrine too. I opens up so many things. I don't know whether we could in such a short time be very helpful or not. May I just make one point on this that I think should get into record. I've talked about that in the letter I sent in earlier, but I would like to say this which has not yet come out in our discussion but I think has been in the back of the minds of many of us. And that is that one important new fact that's going to influence the delivery system is this Developmental Disabilities Act. It's going to influence it because it mandates a way in which the state shall approach a comprehensive program for children with development disabilities and defines the way in which federal monies (monies that are earmarked for this purpose) can be spent. Consequently, we're going to have to know a great deal more about our regional offices, about our state developmental disabilities councils, about their thinking, and about the way in which they proceed to develop programming and so on. I think we've tended to ignore this in the past. Now it's pressing down on us harder and harder and in another two or three years, if this federal program moves ahead as I think it will, this will be an important new thing. Yet, we've been accustomed to thinking simply in terms of the service delivery system in a conventional school organization. Specifically as we get down into the younger age group, we're going to move out into different context, different systems which will have implications for training.

Well, what would you like to talk about at this point? Influencing these various groups or the implications for training or the implications for service delivery. I think it's whatever the group feels would be important to discuss.

JOHNSON: I think the order in which you've stated them is important.

STROTHER: If we take the question how can we influence these various groups, we talked about that earlier. Jim particularly talked about how we influence the Office of Education and other granting agencies. Now do we want to pick up the discussion at that point and consider further what we might do?

KEOGH: May I ask a question? It just reflects my own naivete as to what the LTI does. Is it reasonable to say to the LTI people, how about coming up with a plan? Devise a format that we could propose to the Office of Education so that proposals come in in this form; specify what are criteria for evaluators or panel reviewers or field readers to use.

JOHNSON: That would help everybody.

KASS: Yes, this certainly can be done.

KEOGH: My point is that this group, if we were to meet many days, could come up with a very nice format for research proposals and for review procedures and so on, but we can't do that. We're all going home today to get caught in our busy worlds and it's not going to happen. I wonder is it possible to ask the LTI to take this on as a project; contract it or do it yourselves, and then send it to us and let us have a whack at it.

BRYANT: I think we could certainly do this.

KASS: Not any more this summer. We've got lots of implications right here.

SENF: In Jeanne's absence it's difficult for me to commit us but I think that in my conversations with her she is very much of the opinion that this is a function of the LTI, that it's supposed to be providing this type of integrated leadership. Also, in talking with Paul Ackerman from the Bureau, he seems very receptive to suggestions. That is, BEH seems to be looking for some input and there is now an institution, namely the LTI, through which it can come and perhaps have more legitimacy than it did previously.

KEOGH: An associated kind of thing. If the LTI came up with a proposal, we all responded to it, and it was refined so we all could accept it, it seems to me that the product ought to go to everybody in the field. This would allow for some commonality of opinion, so that if the federal or state agency or somebody says we don't want to do it this way, there are a lot of people who can say, hold on a minute, you're not attending to certain very important kinds of components here.

KASS: May I recommend that we apply this as a suggestion under your broad question here, if we agree on this strategy, how do we communicate, and then design this in several points: communication to the Office of Education. . .

KEOGH: Influence was the word.

KASS: Influence Office of Education and then some of the vehicles through which this can be done, one of which is of course the LTI and then could we maybe suggest some others.

CHALFANT: I think the first step is to take the ideas that have been presented here and redefine them into a guideline. Then, in terms of targets, one would certainly be the Office of Education. Another would be training programs in the country. Then, we ought to get it to the professional organizations and have it discussed and adapted if possible, ACLD or DCLD. Those organizations should get word to the journals as to how we want things done. By getting it out to as many people as we can, I think it's very sensible.

KEOGH: I think there ought to be a more direct communication with the journals, i.e., I think the report ought to go to the journal editors and to all reviewers for the few journals we have available. I'm afraid things get lost. If the plan goes too circuitously, it never gets there and I'd just as soon see it go out directly to as many people as possible.

STROTHER: Just following up that idea, Barbara. Maybe if the LTI could, if this is the appropriate auspice, just take a small and representative sample of the journals in which this material appears and look at the articles and see how many of them violate these requirements and in what respects and then get that back to the ecitors.

SENF: I'll be most happy to do that as one of my tasks. Lee, would you be interested in doing that with me next year?

WIEDERHOLT: Yes.

KASS: Just another point on this that I think would be nice to get into the record, and that is all of this that we have determined can also be of influence I think if we start practicing the ideas of talking up positively a variety of methodologies that people are using. For instance, we're starting a new research methodology here and if that could be sort of encouraged and I'd like to encourage some of your methodologies. I think it would be interesteng to encourage each other and maybe get these on the books and then start developing these rather than putting all of our focus on how are we going to tear down what is in the literature, what is bad about the journals.

KEOGH: Maybe the search is to find some journal publications that are really good models.

BRYANT: I think there's a major stumbling block, and that is that the whole essence of everything that we've talked about comes back to that very early stage of using learning tasks to measure. And so that if everyone uses different learning tasks, it becomes almost impossible to compare one study with another. And the crucial thing is to get a series of benchmarks, criterion measures in terms of this. This might be one of the first recommendations, that we do need studies to establish a standard set of learning tasks that can be used in the descriptions of our population. Because, without it, everything else falls apart because we'd never know whether we were dealing with the same children.

STROTHER: Well, we got on that I think the first day but I guess in relationship to hyperactivity. We tried to use a kind of a minimodel there to determine how it was this might be feasible. We're talking about standard conventional experimental paradigms that can be used across methods.

SENF: Their power lies in the individual investigator's cleverness at changing it slightly to assess his hypothesis and so it is antithetical to list these tasks. Except that I agree with you that for definitional purpose we would like to have something which is standard. So at one stage one needs certain test scores to define the children after which one uses his ingenuity to try to understand the psychology of those children.

KEOGH: But maybe that's a research question that's being asked. We're not ready to do it yet.

BRYANT: I'm just saying that until that bit of research gets done, then everything that we're saying is sort of a futile exercise. Because if we each do a study, we won't know whether we're doing it on the same kind of kids. We won't know what kinds of kids we're using. And that's a sort of crucial first step, it seems to me, to encourage. For example, I think this ought to be very high priority in terms of research funding.

STROTHER: We're now on the question of influencing various groups. We can continue to talk about that or we can talk about. . . Jim wants to say something about service delivery. We might want to say something about training. I think we can really just free wheel on whatever anybody feels they would consider important to get into the record at this point, if that's acceptable.

KASS: I don't think we ought to spend a lot of time any more on influencing groups. This occurs, I think, through action. The only point I'd like to make is that personnel is terribly important. The training of personnel and the adequacy of personnel and the quantity, the numbers of personnel is probably crucial and one that we ought to make some sort of recommendation on, if we can. Some point on how funding might go with relation to fellowships; perhaps how great the need is for teacher trainers, researchers, highly trained persons, how many might be needed. I'm suggesting this as a crucial factor in influencing.

SENF: About the one thing that I wanted to say about personnel is appropriate here. We recognize that our basic research cannot possibly be done solely by people who associate themselves strictly with the area of special education. There's just no way. In fact, it would be a silly thing to take on that task given that other people are already involved in a lot of this research. Some thought has got to be given to how we can encourage those researchers to recognize and research some of the specific difficulties we deal with in this area. They need to become more sensitive to the fine points of this field if their research is to be relevant for us. I know psychologists now doing research on children with reading difficulties completely in violation of many of the principles we talked about today simply because they are not familiar with the area's problems. A lot of us doing learning disability research are dependent on basic research from other areas. As such, we have to be able to bridge that gap between the research on the "normal person" and our specific area of interest, whether it be reading disability or some other. It seems to me that we really have got to stimulate solid research and get the message across that we have to have some money for it. Frankly, I see in terms of relative proportions millions of dollars in regional resource and media centers while only thousands of dollars devoted to underlying process and behavioral research. I think the priority issue is really important, given that our stumbling block involves a paucity of solid, empirical research from which to derive remedial programs.

KEOGH: Jerry, could we restate it and say that we view the cumulation of systematic knowledge a la basic research as a major kind of priority, and see one aspect of that as the involvement of people in other disciplines.

Perhaps most of the conferences and seminars are limited to people who've already demonstrated some competance, presumably in the learning disabilities field, and maybe there has to be some way of getting these other people into it more directly.

HARING: Let me start by saying this, that I've explored with a number of people, a number of researchers in the field, and I use the term researchers loosely defined as they specified a population or taken some kind of measures and running some kind of intervention procedure, and I have an idea that Jerry would have a much more rigorous definition of research. But I've asked a number of these people in education if they would believe that it ever would be possible to maintain a standard measure of behavior as we do distance, liquid, and weight. They all pretty much say that no, they don't believe we could ever reach a standard measure of behavior because of the difficulty in defining the behavior, the difficulty in defining a relevant movement cycle. Eventually we could find I'm sure the movement cycles that are absolutely relevant to reading, in the sense that you can't read without having these skills. But in the substitute for the possibility of ever achieving a standard measure for my purpose in order to get some real value out of the research that's going on all over this country, if the researcher would give only three sources of information about his measurement. I don't care about the population because more important to me is the movement cycle than is the population that's making the movement cycle. If I had the specific movement cycle, if I had the frequency that was counted, and if I had the period of time the count was taken, that's all the information I'd have to know to put that into a bank or to compare it to information that I have, to chart it on the chart paper that we're using, and it would be comparable data.

BRYANT: I'd like to speak to this point, because I don't think it matters whether or not everyone would agree this is the ideal or anything else. I think it's comparable to the use of the WISC in research. The WISC isn't used because everybody agrees, gee, this is exactly what we're trying to measure. It's used primarily as a descriptive device to let others know this is the kind of child I'm talking about. Now I'd be very happy if we could work toward, here are five basic measures that we're going to take. And I would be quite willing to go along with Norrie's procedure on that or any other standard procedure so that we could interrelate on that. But that if we would encourage this to be used everytime there is a study of learning disability remedial education, we start training our students to do this, we start putting it in our own research as a descriptive measure. It may not relate to the study itself, I mean it may not be the essence of measurement there. But it certainly could be the same kind of thing as saying this is a child with such and such a WISC, with such and such a socioecnomic, and the change it would make would be tremendous it seems to me. This is not a subtle analysis of blood. This is a gross thing like temperature, height, weight.

HARING: This would be all that we would need to start with in the beginning because each of us would probably do our own analysis. You've seen how we look at these. If we're using the computer, we employ a regression equation for the best fit line in the plots that we've made say over a period of five weeks. And our prediction would be based upon extending that line. Occasionally we know the rate ranges around which a movement cycle occur and if the rate is occurring at the upper end of that range, we know that it will flatten. If it's occurring at the bottom, we know that the best prediction is to extend on the best fit line. It's very good. This is why when Jeanne McCarthy said we can't make predictions about learning disabilities, well you can. If you've got five weeks of plots on one minute samples or five-minute samples, draw the line on out, and you can pretty much tell when the child will be performing at normal rate.

KEOGH: But you're making predictions on specific behaviors. I think Jeanne was referring to the broader kinds of prediction such as from prekindergarten to sixth grade.

STROTHER: Are we dealing here with the difference between actuarial predictions and theoretical predictions. I think that's an element of it, I'm not sure it's satisfactory. On one hand you can take your empirical data and project that, and the other you take a theoretical model and deduce it.

CHALFANT: But the nature of the problems change over time. It's not always possible to predict what problem's going to arise when a child gets to junior high.

JOHNSON: Again there are variations in the settings too.

CHALFANT: This may be a temporary thing. As we work with more children at junior high age, we can probably predict more accurately despite individual differences.

KEOGH: Corrine's point still has not been responded to.

KASS: I think it's become almost a truism in our circles that everyone should be included--that basic research should be done across a lot of areas. I know this is said at just about every meeting I'm in, so I don't think any of us would feel that we shouldn't do that. What I think perhaps we might have to underscore is some better basic research among the people who are saying it. I shouldn't even say better because I think there's some good research. But I think what we've done essentially in this seminar is work up a very nice set of procedures. The question I think is what can we say about personnel in addition to the procedures on which we can all agree.

SENF: I think that's right. How do you within your own field talk about the personnel, the training of the graduate students perhaps.

STROTHER: Well, can we have some ideas?

JOHNSON: You're asking questions different from those we asked here two years ago?

KASS: Yes, I think more specifically in relation to these questions that we have raised here. If we agree on this research strategy, how do we communicate this, and get others to accept.

STROTHER: Does this follow your track. Are we really talking here about how we can have a more effective voice in the directions of the field.

KASS: Yes. Some professional integrity.

STROTHER: Any ideas on that?

KASS: Maybe we just need to say it, I don't know.

KEOGH: It seems to me that most of the previous discussions I've heard of this have dealt with how many of what kind in terms of the usual categories, teachers, teacher trainers, research investigators, and so forth. I don't see that there's been any kind of positive result from that kind of approach. I'm not sure we can make any kinds of estimates on how many. The question I would be more concerned about is what kind. Again I would come back to my point in support of Jerry that there's an extraordinary amount of work being done in allied areas of study so that it's nearly impossible for any one of us to keep up with current journals in a variety of fields. I wonder if there are other ways of bringing to this field different points of view, or bringing in other people from some quite different backgrounds.

HARING: Doris has raised something that I've been giving some thought to that I really do like very much because it makes so much sense. A lot of people are interested in children who don't learn and they come from a variety of undergraduate experiences. And if we did systematically take a record in any way that we want to do it of the entering behaviors and if we could specify what we expected that their entering behaviors would need to be, we could probably design at the most two three-hour courses. I feel confident that we could get most bright people out of a variety of undergraduate programs to meet expected entering behaviors and get them on to a specific training program. I would like to at least speak to that and rearticulate the plan that Doris had expressed in her presentation. I would like to see the Leadership Training Institute give some further thought to this in reporting. We come from such a wide variety of backgrounds that it seems almost unreasonable to expect all the people who go into a leadership role to come from the same undergraduate program.

JOHNSON: And I would be a little reluctant to try to specify what they should become. There is a freshness in thinking as they take cognate areas outside the field and they come in with various backgrounds. That's why I would hate to specify terminal behaviors for any of them.

STROTHER: Well I think what you're seeing Doris, in terms of the diversity of backgrounds that the students are bringing to you now is really a prediction on the part of kids who would by preference go into other fields that the opportunities in this field are going to be more numerous or better and therefore they're redirecting themselves at the beginning of graduate work.

JOHNSON: And sometimes it helps by getting information in the bulletins. We now have stressed the interdisciplinary approach on research in special education. A student may combine LD with anthropology, psychology and sociology, etc. Sometimes just having such programs made known to these outside students helps.

STROTHER: Maybe we can note this. Jim's got something he'd like to get into the record. Why don't you go ahead?

CHALFANT: What I'm going to discuss stems from my work primarily in Highland Park, Illinois and Nebraska. It's concerning delivery of service systems. Our biggest job is not going into a vacuum and creating something from scratch, it's going into an existing situation and modifying that situation, so I would like to outline a seven step procedure for influencing or introducing change in public schools.

I. The first step is to simply go in and take a baseline, study the existing situation. What we must do then is study the existing situation and there are a number of variables that we ought to look at. What is the purpose of the organization? The people in the organization will disagree if you ask them to rank order the objectives of the organization. There are some good procedures for getting at that from the field of school administration. What population are they serving in the way of kids if we're talking about schools? What geographic area is involved? What organizational structure is being used? What is their financial base? What kind of line staff responsibilities and relationships do they have? How are they utilizing their personnel? What are their attitudes toward each other as colleagues, toward their organization, toward those they serve, and how do they view themselves in terms of attitudes? These are the variables I try to look at in studying an administrative unit.

I think that it is possible to do a good job of a differential assessment of administrative organizations.

II. The second stage is simply to identify the greatest strengths and the greatest weaknesses of the organization. And I should add that when you do something like this, you should try to involve the staff from the beginning. This immediately threatens certain staff members with whom you have to deal.

III. What I tend to do is to go into a series of problem-solving meetings where we generate alternatives for these problems and then we set our priorities.

IV. Once we have alternatives and priorities set and we have decided what we are going to do and how we are going to do it, we must cultivate patience. Some people want to do it at once in a revolutionary way. I encourage them to set up an in-service training program. Conduct the analysis in the fall; then train them in the spring. Prepare everyone for what's going to happen.

V. The fifth stage is field testing the alternatives. Take one school. If a district wants to decategorize programs they might begin with just a few programs in one school, and field test it.

VI. The sixth step is generalizing the plan to the entire administrative unit.

VII. A seventh step would be to establish a demonstration center or centers to make visible what it is you have done to others. Set up a procedure so other people can come in and observe what's going on. Send staff out to talk with people who don't visit. There should be a procedure for handling visitors and that's a science in itself. To do this there are a number of patterns. You could seek support of some kind in terms of state or the federal government. Then hopefully if what you have works, you could test it out elsewhere, and go into a multiplier effect. But generally what I described is no different than what Dr. Strother described earlier. It can be done administratively. The skills we need for this must be taken from the people in school finance, I find people in group dynamics in guidance and counseling departments very helpful, and school administration. These are where the tools are. The trouble is they haven't been applied on our problems.

STROTHER: Well this answers a little bit the need you were expressing, doesn't it?

WIEDERHOLT: Yes, it does.

BRYANT: I'd like to ask a procedural question. We spoke of the possibility of taking the questionnaire and then of returning it. Is that still. . .?

STROTHER: We had some little discussion of this outside, and we hoped that we might do it collectively this morning rather than having it hanging over our heads when we left. I think that's probably a general feeling.

KASS: I think that would be just fine because I think we have a nice composite that we have in our notes and transcription from this morning.

STROTHER: Are you satisfied with it?

BRYANT: I think we have addressed ourselves to many aspects of it and I think we could do without the going further. I just didn't want to leave it up in the air so that some people would feel they needed to and other people would not.

STROTHER: Good, that closure's helpful.

Well, where are we now. We seem to be running out of steam. We're at the point where we're free associating. Is there anything else you'd like to get into the record or anything you want to be sure gets stressed in it. I come back to Jerry's notion that we want to say, I think this what you were saying, we want to say very explicitly to BEH, you'd better take look at the balance of expenditures of your funds as between the funds that are dedicated to basic research and those that are going into research and demonstration centers and other things. Some things if they're outlined are going to have an immediate impact, but if they're buried in the text of the discussion, they may be lost.

KEOGH: Could I add something to your statement? I think it's not enough to say to any agency that the priority for basic research ought to be higher. Added to that has to be that we think we can propose reasonable format for you to use in which to evaluate proposals and to come up with directions. It adds a lot of power. I'm sure that any agency is going to say, you're right, we're trying to do this, but we look back after three years and say that was poor research. We may have a little bit of a lever now to say, look, here's at least a tentative proposal.

STROTHER: Well, you know another thing that came up, if I can just interject this and I'm just reverberating to it now, I'd sort of forgotten it. We got on the topic of the review process and the approval process for allocation of funding. Is there anything explicit we want to say on that. That would be important?

HARING: This is related in a way. I'll let you tie in. The funds that are available now in research in the specific area of learning disabilities are not categorical, and they would be available only through the Division of Research in the Bureau of Education for the Handicapped. But funds that are available through Ackerman's branch, the branch which includes learning disabilities and which is administered by Larry Lieberman, are being disseminated through the state child service centers and there are about 23. Those are certainly not research oriented in any way. Then we have this Leadership Training Institute which is primarily responsible for looking at the guidelines design and make recommendations with respect to leadership training in research and in training itself, in training service personnel. The weakness that we have right now, and it might be that we should make a comment about this, is specific funds that could be earmarked for research in learning disabilities. I'm not sure they're not going to come out of the branch that we're talking about because that branch is funded, they're getting now all the money they're going to get. In fact, if you know the history of that, you know the little dab of money that went originally into that was kind of brought out of other budgets rather than given from Congress. Congress gave an additional ten million dollars spread all over the BEH budget and it was taken out of here and there to set up a branch which could have within that branch funds for the LTI and the service centers.

All right, now where does this go? It goes like Jerry doesn't have much going for him in the way of basic research in learning disabilities because there are no funds to do this. It seems to me that the responsibility of the LTI and BEH is to say, look, can we have special attention to the research needs in this area and can we get from the Division of Research some kind of a commitment to set aside some money for research in learning disabilities at this very critical period of development.

CHALFANT: The Professional Advisory Board to the research program usually sets priorities and guidelines. If somehow information could be gotten to them either directly or through BEH, wherever the proper channels would be, that might help also.

STROTHER: One trouble is it's meeting today and we don't have another crack at it for a year.

HARING: We have one more crack at it. We have a crack at it through the National Advisory Committee. If you would so designate or so charge me, I would bring this issue up at the National Advisory Committee which meets the day after we get back to Seattle.

STROTHER: We so charge you.

BRYANT: It's frequently a point, and I think it's been mentioned here, that a lot of times research not only has the problem of not being able to interrelate but that it's still fractionated even if it could interrelate. And there's the question that comes up of the value of programmatic research. There has been I think a couple of times the idea that we perhaps need somewhat more programmatic research. But I don't think we've addressed ourselves to that. In the thing we worked out this morning, it had to do with how do we bring the field closer together but we really are not talking about programmatic goals.

STROTHER: Well, we might keep in mind what's happening right now in the field of reading. You know, that field in the last three years has just addressed itself to this problem. You remember the discussions on the Dyslexia Committee on convergence technique and so on. The Office is now moving ahead to define a framework within which programmatic research can address itself to the things that are significant.

JOHNSON: I like your word efficient throughout the morning. If we could also demonstrate that the field has some way of efficiently coordinating research, it may not take as much money as we think it would if there were basic research objectives.

STROTHER: The establishment of the National Institute of Education was incorporated in the Higher Education Act that just passed, wasn't it? We haven't seen much in the way of publicity but it was my understanding it was. Now if that's the case, this is going to be a new factor in the field because this will be one of their major responsibilities, if they are impressed with the importance of the field of special education.

CHALFANT: How can the U.S. Office of Education help stimulate this field to answer many of the questions that are concerning them in the research area. They have held research conferences on the sparsely populated regions because there was no research on that. There have been research conferences in the area of the deaf. We should get federal people involved in such a conference and generate research priorities as they did for the deaf at the Virginia Beach Conference. If we had a conference on research in this field, priorities, and the federal people having a hand in running that conference and in setting up their own priorities, we are more apt to get money than if we did it by ourselves.

KEOGH: It's been my argument that we find ourselves in the position of being reacters, but that's not enough. We also have to be inputers before we are put in the position of being reacters.

KASS: Could I maybe close this particular part by saying that I think what we have here are some very definite suggestions and recommendations. What you'll see when you get your transcription, occasionally we will insert actual recommendations possibly with some stars or in a section that we'd like you to look at and these will be very specific recommendations that could be followed such as, one, inform the National Advisory Board, which then will be carried out. Another one possibly, define a frameword for the programmatic research and then a suggestion of a conference. These would come out of this. We certainly can't take care of the solutions to all of this at this point so maybe we could do it that way.

KEOGH: I think that's fine.

KASS: I wonder if I could ask just a couple quick questions that I need a little help on and maybe just your free association on this, just very short quick answers. And one is, is there a curriculum content which you feel is specific to the field of learning disabilities. I'm asking this because of the published materials that are specified and are sold across the country as content in learning disabilities.

HARING: As far as I'm concerned, there's no curriculum that's specific. There's really no way we can identify a special curriculum.

KEOGH: I would support that, for different reasons, but I'm strongly in support.

JOHNSON: There are goals and there are rationales but not necessarily curriculum, I would agree.

KEOGH: The problem has been the inappropriate use of materials because they're available and because they don't know what else to do.

SENF: I have had the experience with some of the clinical psychology graduate students who are increasingly interested in problems addressed by special education and their consensus is that they teach all these materials and fail to keep in mind that they're teaching children. Now this attitude is in part the clinical psychologist's empathy and individual focus but there may be something important here. The concern for whether the teaching materials have the appropriate color or shape whether they move through the machine at the proper rate, whether they're packaged in cassettes so the kids can't tear them apart and all these other considerations seem to get in the way of the basic Axline notion that you're teaching children who are integrated systems, who have needs and who respond to you. This whole dimension is not presently addressed in the field of special education as near as I can tell.

STROTHER: Would you want to add to the record, I think that's what's implicit in the thinking of all of us, that there is a crying need for evaluation of the great diversity of material that is now avialable. We have really outlined what we think would be the appropriate strategy for that evaluation and it's this direction that we need to go.

BRYANT: I think we're faced with two problems here. One is the frequent cries that we're under pressures and we can't wait until all this research is done. And secondly, that we need to disseminate in usable terms the work that comes out of the research. And I wonder if there isn't a kind of solution to this. And what I'm thinking of is a Buros type review that gets individuals from somewhat different viewpoints to talk about methods, materials, and so on. And that as the research comes out, that somehow this gets fed in to give more specific information, something like the ERIC-CRIER's targeted publications. I don't think it needs to be necessarily in the form of a book. It might be a journal, it might be anything like this. But I wonder if the field doesn't need to make an approach to making useful to the practitioner the expertise. So that, for example, we were talking about the Frostig, it wouldn't be that they were just reading the manual or reading something like this, they would be reading the doubts. And, as research becomes available, and for example it is relatively available on this, they would be getting some kind of word on that.

STROTHER: I think that's an important idea.

Well, we've got only a few minutes left and if you don't mind I'd like to do something different for a moment. That is, take a look back at what has happened in the last few days in terms of process. It seems to me that this has been an unusually stimulating and fruitful discussion. I think it would be helpful if we'd try to analyze why it has, if we agree it has. One factor seems to me to be the fact that we've wasted very little time in debate, in fruitless effort to persuade other people of our own point of view. We have concerned ourselves with communicating clearly our thinking but put equal emphasis on understanding the thinking of the other participants. We have disciplined ourselves to address the task that we wanted to accomplish and try to formulate that task in terms that were acceptable to different points of view. I would appreciate your reactions.

WIEDERHOLT: I think that probably one of the first things that you could point out as being most helpful was Dr. Strother as chairman being very effective at interaction and bringing people back to a point and synthesizing a lot that has been said in the past. That's very important in a group process.

JOHNSON: And I think your initial presentation kind of set the stage for a climate.

STROTHER: Well, there are a lot of things of course that helped, the comfort of the situation helped, how well we've been taken care of by everybody, and so on. Are there any ideas about where this kind of process might go from here, what we would want to do if we tried to organize additional proceedings of this sort.

CHALFANT: I see people getting together out on the veranda and down by the swimming pool pursuing certain lines, not because they were brought here to do this but because each person is asking himself certain questions about his own performance and what he's doing. I think everyone has an honest interest in what the other fellow's doing because we may be missing out on something. The reason we haven't had a lot of debate here is because we haven't tried to persuade everyone to our own points of view. We have simply tried to explain what we do and tried to understand what the other person is doing. Perhaps what we need to do is get groups like this together with specific objectives, and see where the overlaps are.

KASS: I believe thoroughly in the principle of novelty and I think there are a number of ways of doing group process and setting these things up. And I think it's nice to pursue an approach for a while and then it's nice to revise and change. I think we've found, for instance in the past, that we've had lots of conferences on training and finally we've reached a point of diminishing returns. And now there seems to be a real impetus toward discussion of research. And this will I'm sure proceed for a while and I'd like to see it continue.

HARING: One of the things that has caused me great excitement here has come out of my high respect for each person here of course but has more than that come out of the real exciting possibility that the behavioral geologist, the cognitive process person has some very important ways of showing the measurer (and I use that term in the loosest sense), the driller where to go, where to find the richest resources for remediation. And I would really like to have all of you give some thought to how you can show the person who concentrates in this very microscopic limited way where to take his drill rig next, where to do his probing. This is what I would like to get from all of you, and I have a great deal of hope for the possibility of this happening.

KEOGH: By the same token, though, it may provide some of the rest of us with more impetus to make more precise our measures.

Just in the practical sense, I'd like to comment that I'm most grateful to be in a small group where there has been time to listen to people. The size of the group, the actual physical surroundings, and the time scheduling has made it possible for us to keep a relatively high level of interchange without fatigue or just numbers overwhelming us.

STROTHER: It's been interesting to see the extent to which our thinking has converged as we've gone through, so that now we can almost read each other's minds. Somebody doesn't need to say very much but he just cues off and everybody says, sure, that's the way I'm thinking too. It's curious how that happens in a group process, what brings it about, and how much communication is possible once you reach that point.

SENF: I was surprised, in fact very upset, at the outset by how divergent the thinking within this group must be, even to the point of asking myself what I was doing here. And then as I began to look around, I realized that everyone could ask themselves that same question quite as well. I think there is a lot of strength in that diversity. That diversity makes one more honest. It's useful for me because I'm particularly involved in research and see tremendous needs there. Now I find other people who also recognize that need and yet I recognize that most of their personal resources are devoted somewhere else. One can't at one point say, I respect that person for sharing my belief, and denegrate the activities in which they are engaging; there must be something there too. It is really very broadening to have to fit all aspects of the field into one's thinking.

KEOGH: Maybe the recommendation should be that Charles should become a rotating chairman. . .

STROTHER: Well, it's time when we must adjourn. Let me speak for all the participants in thanking our hosts and hostesses very much. This has been a very pleasant and fruitful experience.

KASS: And we thank you too.

BRYANT: This has been very useful for us and I think this is one of the best meetings that we've seen. I think that it's mostly because Corrine in the original conceptualization kept saying we've got to keep it open so it can shape itself. And, at the time, Corrine, I wasn't quite so sure but I think it worked out very well.

APPENDIX H

NEUROLOGICAL FACTORS IN LEARNING DISABILITIES: A REVIEW OF THE NATURE OF PRESENT CONTRIBUTIONS OF NEUROLOGY AND APPRAISAL OF FUTURE RESEARCH NEEDS FROM A NEUROLOGIST'S POINT OF VIEW

by

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PART I

The classical neurological examination yields most precise information about brain localization and specific brain disease when applied to clear loss of function of a subcortical nature in a previously normal adult. In such cases, post-mortem anatomical confirmation of function-structure relationships is available. But the neurologist is in quite another situation when confronted with the child who has not met a scheduled criterion of learning a skill presumed to be dependent upon higher cortical function. For these cases, no anatomical confirmation of localization is forthcoming. Has the neurologist anything to offer at present? What could we expect to gain from research by a neurologist in the future?

In reviewing recent textbooks of neurology, one finds increasing numbers of pages devoted to irregularities of neurological functioning which a decade ago were considered to be in the realms of psychiatry or clinical psychology, but which are now collected together under the broad title of "minimal brain dysfunction." The history of the development of this term and its broad range of meanings is reviewed in the reference list at the end of this paper. From the neurological textbook point of view, however, these irregularities are worth noting either because they may be the initial or the peripheral signs of a more serious neurological condition, or because they serve to alert referring educators, psychiatrists, or psychologists that there is "something organic" about the patient; rarely is the orientation one of trying to make syndromes of irregularities which correlate with specific behavioral complaints. The irregularities are listed as "soft sighs," and it is noted that these occur along with "hard signs" in patients with known, specific, definable neurological diseases; the inference often drawn is that the "soft" (usually neuropsychological) signs are the result of "diffuse" but minor brain pathology. If the child's history indicates that he has been at risk perinatally or later of having suffered some physical insult statistically correlated with brain damage, this increases the neurologist's confidence that the "diffuse soft signs" and the behavioral complaint are related.

These general concepts which yield a diagnosis of "Minimal Brain Dysfunction, manifested by ________________" are now becoming so widely known that competent pediatricians are able to screen most such children and medicate them with the widely publicized stimulants. Why, then, are so many children still referred for neurological examinations?

The present writer thinks it is because other professionals are looking for something more from the neurologist, who is trained in a tradition of dissection of observations, a concern for specifics rather than complexes of behavior. Although this habit of analysis has been more fully developed in diagnoses involving subcortical systems, there has been a recent resurgence of interest in cortical or "higher cerebral" systems, with a gradual replacement of the semi-philosophical "faculty psychology" terminology of a previous generation of neurologists by a task-analytic terminology. Interest in the concept of disconnection syndromes and in the effects of stereotactic surgery has brought back localizationism in a modified form, so that younger neurologists think in terms of critical circuits or loops of connections rather than "centers." On the other hand, there is less tendency to regard loss of higher integrative function as simply mass-related, or "diffuse."

Two sources of data and technique become important for this sort of modern neurologist. One is the body of data provided by neuropsychologists about the adult with known localized brain damage. Constellations of "soft signs" repeatedly correlated with certain lesions thereby "graduate" to the status of "hard" syndromes in adults, and the neurologist looking at children may proceed to ask, "Do I see an analogous constellation in children?"

The second source of input to the modern neurologist is the wealth of child development data accumulated by pediatricians, psychologists, language pathologists, and special educators. Only with this data can we judge a given child to be impaired on a task which we have "borrowed" from investigations of adults. We cannot form clusters of impairments from which to infer cerebral mechanisms unless we can define for each task what is considered impaired for a child of a given age. We can also use these data to define developmental disorders as those in which there is performance of a given task at a level below the child's chronological age and below his own performance levels in other tasks. (This is in distinction to disorders which are deviations from any behavior ever seen at any time on a developmental continuum.)

The neurological examination of the child referred with learning disabilities can, even at this stage of knowledge, make use of the classical neurological dissection of observed behaviors into specific components. It can then use for comparison developmental schedules for neuropsychological tasks in normal children. And it can then bring in knowledge of the clinical-anatomical or physiological correlations known to exist in adults with syndromes of analogous "soft signs." The neurological examiner then states as facts any specific neurological indicators clearly outside of the normal continuum, any developmental indicators (on the normal continuum, but below the child's age level), and the child's personal physical and family history. He searches for a "pattern match" in the known adult syndromes. If this is negative, he falls back upon a strictly phenomenological "pattern match search" through previously seen and described childhood cases. It is this writer's hypothesis that the neurologist is more useful to other professionals when he is able to suggest, even by analogy, relationships between childhood and adult syndromes, particularly when these share the same behavioral complaint. Lost in the list of childhood signs, we are forced to admit that there is no cluster which at present predicts or explains any specific behavioral complaint.

PART II

The end of the last section implies that there is more that the neurologist could be contributing to the understanding of children with learning disabilities. This will not be accomplished without research goals. In this writer's view, the neurologist must get involved in the developmental examination of normal children in a more quantitative manner. At the present time, most clinicians, aside from psychologists administering psychometrics, score skilled motor, language, adaptive and social acts in a criterion-referenced, rather than norm-referenced manner. For example, a neurologist may note whether or not a four-year-old child is able to hope, i.e., meets the motor criterion of "hopping expected" at four years; but when examining a five-year-old, already past the "expected-to-hop" criterion, the neurologist has no quantitative way of evaluating how well the child hops compared to others of his age. Hence the often subjective-sounding nature of the neurologist's report that "he hops poorly for a five-year-old." The neurologist can and should borrow from his psychologist colleagues the latter's techniques of collection and tabulation of normative data, with means and standard deviations, or percentile rankings. The usual tasks of the examination should be standardized in "neurometrics," so that balance, gait, arm posture, drift, tone, rapid repetitive or alternation movements, eye movements, etc., can be seen in the context of the range of normal at each age. This would free the neurologist from his heavy dependence upon observed right/left asymmetries, being most helpful in resolving questions of intra-individual discrepancies among specific factors of functioning. For it is in profiles of discrepancies (like the psychometrician's "scatter"), rather than in asymmetries, that clinical syndromes emerge in neuropsychology.

Neuropsychology implies a collaboration between neurologist and psychologist, which is indeed the next order of research business in defining "minimal brain dysfunction" in terms of more precise subgroups. At the end of this paper will appear a list of tasks which neither discipline has in the past measured in normative studies; the need for these items in an expanded battery of "neuropsychometrics" will be explained in the course of description of the present writer's experience with different kinds of "minimal brain dysfunction."

The psychologist needs to have his complex cognitive tasks dissected into smaller bits by the neurologist; the neurologist needs to submit his smaller, more specific tasks to the normative-referencing approach of the psychologist. Priorities as to which tasks should form a normative battery against which the child with learning disabilities should be checked arise, in turn, from the clinical "hunches" (more formally called impressions) generated by clinical experience.

PART III

In a practice devoted to the examination of children with learning disabilities, certain repetitive syndromes have been observed. Although descriptions remain at a qualitative, sometimes almost literary, level, some attempt at classification seems a prerequisite for further investigations. It appears most reasonable to start with the "chief complaint," in the classical medical manner, much as one would with headache or seizure patients, and then use history and physical findings to formulate a differential diagnosis. (No good names exist for the differential-diagnostic categories.)

Many children are brought to the neurologist with mixed or vague chief complaints; these will be left aside for the moment because, frankly, it is simply too difficult to generate even a primitive classification from these cases. Also to be left aside, not for lack of importance but for addition of complexity, are the psychogenic cases presenting with the same chief complaints.

The relatively "pure" chief complaint categories, in order of frequency seen, are listed below:

1. Behavior disorder characterized by unfocused hyperactivity, distractibility, poorly sustained attention, and/or poor impulse control.

2. Learning disorder characterized by difficulty with all school subjects dominated by language content, including verbal memorization, following instructions, reading and spelling.

3. Learning disorder restricted to language arts skills (reading and spelling). Note that this "pure" category is more restricted than category 2., right from the start.

4. Learning disorder confined to coordinative skills, athletics, self-care activities, and handwriting are all areas of complaint.

5. Learning disorder confined to arithmetic. (Note: this is exceedingly rare.)

Also often seen in combination as chief complaints are:

1. and 4. - very frequent

2., 3., and 5. - moderately frequent

1. and 2. - moderately frequent

5. - combined with spelling, writing, and spatial relations difficulty approximates the "Developmental Gerstmann Syndrome," seen by the present writer in only 11 cases over a 3-year period.

For purposes of discussing models for future research and justifying the list of research tasks listed at the end of the paper, only pure categories 1. and 3. will be examined as we follow the path of differential diagnosis.

1. This is the most commonly recognized and publicized cluster of signs of "minimal brain dysfunction." Often such children, already recognized as "organic" and medicated, are sent to the neurologist, where inquiry is made about prognosis for "these" children or how long "they" have to take medication. Although reassuring statements or pessimistic statements about "this" group can be found in the medical literature, close inspection of the criteria for lumping "hyperactive" children together leaves one uncomfortable. For example, one article discusses the prognosis for children admitted to the study on the basis of having "any four" of a list of 35 widely-dissimilar characteristics. To find a "pattern match" for the child one sees before one's eyes in the office is the usual prerequisite for a physician to diagnose, treat, or prognosticate; and in the present literature, little help is to be found. Thus we medicate "empirically," switching to a tranquillizer if a stimulant does not help--rather like the state of the art of treating "epilepsy" without further characterization.

Like epilepsy, I believe that the complex of "organic" syndromes having a chief complaint of hyperactivity are common because of the multiple sites in the nervous system at which the arousal-alerting-inhibiting systems, which form the core of the neuraxis, can be impaired. All goal-oriented behavior can be "diffusely" disrupted by such disorders, but the lesion (anatomic, physiological, or chemical) may not be diffuse. Differing qualitative characteristics of disinhibited-unfocused behavior, plus "neighborhood signs," should differentiate subgroups of "hyperactives" just as they do in the epilepsies.

I will give the examples below just to show where we can start, but I know that documentation will require the use of electrophysiology. Measures of EEG phenomena correlated with arousal and attention, autonomic monitoring of heart rate, pupillary reactions, galvanic skin responses and the like, constitute tasks on which neurologist and psychologist need to collaborate in sorting out the "organic hyperactive syndrome."

Example A. A child with psychomotor seizures and left temporal EEG focus. Neuropsychological findings are pupils chronically dilated and impaired verbal memory. Quality of hyperactivity is dysphoric, aggressive, destructive, unpredictable impulsivity. Not easily distracted by environment, even when it is desired by adults to distract him from pursuing what he wants. He seems truly "driven" by a demonic emotionality, rather than "dragged about" by outside sensory impressions. He does not respond well to Ritalin or Dexedrine, may have his psychomotor seizures worsened by phenothiazine tranquillizers, and is difficult to manage at home and in school.

Example B. A child who is placid, sweet but not very intense in emotional ties, flits about aimlessly and accomplishes little. Neuropsychological findings include poor eye movements to verbal command, clumsy gross and fine motor skills, perseverative tendencies on sorting and categorizing tests, inability to attend to more than one stimulus at a time or to even one for a sustained period of time, and a euphoric disregard for small social conventions. He is made into a "complete zombie" by tranquillizers, and has a modest improvement of length of attention span on stimulants.

Example C. A child who has been "on the go" since he started to walk (or rather run), who is athletically agile but heedless of dangers, very "verbal" but never stops chattering, a happy, friendly youngster who "does not act his age." Neuropsychological findings reveal only fine finger dexterity (and handwriting) below age expectation, and the child behaves amazingly well in the initial examination, seeming to belie the parental and school history. Despite rocking and fidgeting in his chair, he does well on all specific cognitive tasks (abstraction, memory, etc.) but "thinks out loud" thoughout. He does so well on Ritalin (including better handwriting) that at his parents' next school conference, they hear him described as "an asset to the class."

Further permutations could be given, but the point that there are different hyperkinetic-inattentive children has been made. The direction in which research could go with examples A, B, and C would be set up the model of A as a "limbic drive excess" problem, the model of B as a "fronto-caudate deficiency" problem, and C as a developmental disorder of "scheduled" frontal (pre-frontal?)-thalamic inhibitory system development. C is different in that he can be restored to virtually normal behavior by stimulant medication, so that it is clearly important to follow him to the teen years when the medication is stopped and to map his family history in detail. The prognosis of A, B, and C should not be lumped together.

2. The second most commonly occurring chief complaint category is really that of all the varieties of Language Disorders and their classroom manifestation. Category 3. is, in a sense, a subcategory of 2. which recurs with sufficient frequency to make it stand apart. Also, it is the category most likely to be missed by physicians in general, or even to be called "psychogenic" by some school personnel--a tribute to its "purity." Category 3. as a chief complaint corresponds roughly to Orton's Specific Language Disability or Critchley's Developmental Dyslexia, although recently many such children have been called "visually-perceptually impaired" by other clinicians. The diagnosis of these children seems mainly one of exclusion from other nosological entities, even

from "minimal brain dysfunction" itself, perhaps because the area of dysfunction is not even as pervasive as that of the Example C "hyperactive child." Of course, there is a legitimate argument that children with such subtle, limited difficulties do not even deserve a "diagnosis," that they are normal variants no more "organic" than the tone-deaf or color-blind. A disorder manifested only in skills involving written language is, of course, a disorder relative to cultural demands, and it becomes a matter of personal philosophy whether or not the neurologist should be concerned with such brain variations in our society.

In my own practice, I have been particularly interested in applying the neurometrics of a "high power" (by analogy to a microscope) examination to the 42 children seen with histories of reading-spelling difficulty alone. The alone is emphasized because if one tried correlations of examination variables with poor readers in general (i.e., the total population with retarded reading primum inter pares in their complaints), nothing was very dramatically positive. Many of the conflicting statements in the literature about dyslexia (such as whether visuospatial factors are involved, or the Gerstmann Syndrome is also present) appear to arise from the use of the "poor reader" sample not further screened, even if matched for "mental age and chronological age" with the control group.

The "poor reader-speller alone" group confirmed some impressions from the literature, however; 88% were from families with the same or forme fruste language-arts disabilities, 64% were right handed, -footed, and left-eyed for sighting, 41% had histories of delayed, dysfluent, or dyslalic speech. On examination, in addition to the "mixed dominance," the following percentages were found: 1) Naming and word-finding difficulties, manifested by long latencies and circumlocutions, in 59%; 2) subtle fine-motor anomalies--see below for description--in 53%; 3) errors in right/left responses below age expectation, by A. L. Benton standards, in 41%; 4) sentence repetition (Binet Scale) and digit span (Wechsler Scale) below age expectation in 41%; and 5) visuo-graphomotor (Bender Gestalt) difficulty in 30%. Not found in this group were an excess of left-handedness, inattentiveness, abstraction task difficulty (categorization, similarities WISC and block design WISC), spatial orientation difficulty, finger-localization difficulty, or gross-motor difficulties.

Now it is instructive to compare items 1) and 2) reported above in terms of the confidence level of the diagnostic features, i.e., in terms of the possession of "neurometric" norms. At the present time, item 1) is a purely qualitative, impressionistic matter, noted by a clinician who is familiar with the language behavior of adult aphasics. The language behavior of the poor reader group can only be said to be "reminiscent" of that seen in adult-acquired syndromes until we have better normative data on specific naming tasks (with latencies measured), word productivity, and word finding (sentence completion, e.g.) in children of each age. Till that time, the impressionistic recording of "word-finding and naming difficulty out of proportion to general intelligence" is open to the repeated question, "How do you know whether that is 'organic' or 'psychogenic'?" In contrast to this situation, item 2) has been studied (Denckla, unpublished data) in normal school children; the resulting neurometrics allow one to see that the poor reader group does indeed show an interesting anomaly of fine-motor performance--excessive slowness of finger movements of the left hand with respect to the right hand. If one does not know that the right and left finger movements speeds of normal children are virtually identical, then finding slower left finger movements in right-handed poor readers cannot be notable as an anomaly! One's "common sense," in fact, would probably lead one to discard entirely the clinical finding of slow left finger movements in a right-handed person.

The study of finger skills was originally undertaken in a neurologist's attempt to dissect poor visuo-graphomotor performance, 5) above, into components visual and motor. The striking competence of "poor readers-spellers only" on tasks with visual and spatial loading other than those requiring expression through fine-motor skills made this a logical undertaking. There is still a great need for visual and visuo-spatial tasks with minimal verbal or fine-motor processes involved--some kind of check-out of the Bender Gestalt difficulties on the "perceptual" side. To some extent, the Raven's Colored Progressive Matrices can serve as a multiple-choice alternative, but then the 6-choice format in itself penalizes younger or inattentive subjects by its very nature. It is also noteworthy that we do not really have at our disposal any tests of visual memory (immediate or long-term) which are constructed so as to minimize verbal and fine-motor factors.

The study of fine finger skills, with its surprising yield of the anomalous slow left hand, suggests again that Orton's thinking about irregularities of interhemispheric relations may well merit revival. The right-handed, left-eyed pattern also raises questions of this nature; is the left-eyedness an eye-movement-related or a visual-field-related preference? Does the slow left hand phenomenon suggest faulty "pacing" from dominant left hemisphere to right? Perhaps these children should be studied with the equipment and tasks used by Gazzaniga et al. to study patients with severed interhemispheric connections.

The observations and discussions above have been given in order to illustrate to the reader the interplay between more quantitative neurometrics and more familiarity with adult-acquired syndromes. A final example consists of a subgroup of the "poor readers-spellers only" who were particularly severe non-readers and were found to have color-naming defects (Denckla, unpublished papers). The idea of testing them for color naming came from knowledge of the striking association of color naming defects with alexia in adult brain damage. Normative data on the speed and accuracy of color naming in school-age children had to be collected (Denckla, unpublished data) in order to be able to state that the dyslexic boys in question were in fact impaired. One could then scrutinize the other characteristics of the color-anomic dyslexic cases and find that they paralleled in profile adult left occipitotemporal deficit (Denckla, unpublished case report). A strong case for the pathways involved--where no other anatomical evidence is forthcoming--can thus be built, bringing us at least somewhat closer to understanding the mechanisms, and at least delineating a syndrome which can be recognized and followed for natural history.

In conclusion, it can be seen that the neurological approach suggested above resembles a microscopic examination, starting from a low power scan of the entire field (analogous to finding "something organic" in history and physical findings) to middle power (writing "manifested by language disorder," e.g.) to high power (delineating a specific syndrome or profile). Although localization in the traditional sense is not a reasonable goal, utilization of analogies and critical differences between childhood and adult syndromes sharing similar complaints brings us closer to a clinical classification scheme. At this stage of exploration of learning disabilities, or minimal brain dysfunction syndromes, the neurologist seems to be in a position to help make order out of what sometimes seems like a mass of endless individual variations.

SUMMARY

In this appendix, it has been assumed that the reader is familiar with the history of the concepts of "developmental disorders" and "minimal brain dysfunction," as used by neurologists. (The recent references appended review this background.) The main themes of this paper are future-oriented. We have passed beyond the stage of assigning the term "organic" to a child's learning disabilities, and the variety of syndromes which in fact exist belies any unitary statement about *the* child with minimal brain dysfunction. It is proposed that the traditional neurological dissection of details of functioning, wedded to the traditional psychological measurement methods, could and should produce "neurometrics" for normal children. With this background, more sophisticated syndrome profiles for learning-disabled children could be described. Analogies between these profiles and syndromes of adult acquired neuropsychological deficits offer the nearest approximation to the anatomic localization available in other aspects of neurology. In addition, moving back and forth between adult and childhood syndromes is cross-fertilizing in terms of eventual understanding of brain mechanisms in learning. Greater precision in classification and nomenclature of childhood syndromes would be the most immediate benefit and the prerequisite for clinical studies predicting certain learning problems, establishing treatment, and following prognosis.

Specific research projects (normative preceding clinical) in the following areas are suggested:

1.* Motor examination (unilateral balance, hop, gait, rapid alternating and repetitive movements of hands and fingers).

2.* Naming, word-productivity, and word-finding speeds (or latencies).

3. Eye movement examination recording, under specified stimulus conditions.

4. Eye preference definition, in terms of movement or visual field significance.

5. Visual and spatial discrimination and memory tests constructed so as to minimize verbal and motor factors in response.

6. Autonomic monitoring relevant to recording correlates of attention, vigilance, alerting, and habituation.

(*denotes areas studied in part by the present writer).

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APPENDIX I

SUMMARIES OF RESEARCH
ON THE
REVISED ILLINOIS TEST
OF PSYCHOLINGUISTIC ABILITIES

Samuel A. Kirk

May 1972

PREFACE

In 1961 the experimental edition of the ITPA was published. This edition resulted in a series of research studies which were summarized by Barbara Bateman in *The Illinois Test of Psycholinguistic Abilities in Current Research*. IREC, University of Illinois, 1965. Selected research studies up to 1970 were included in Kirk and Kirk, *Psycholinguistic Learning Disabilities: Diagnosis and Remediation*, University of Illinois Press, 1971.

The Revised edition of the ITPA was published in the fall of 1968, with an accompanying book, *The Development and Psychometric Characteristics of the Revised Illinois Test of Psycholinguistic Abilities*, by Paraskevopoulos and Kirk, 1969. Since those dates, research studies have been reported in increasing numbers in the literature in numerous periodicals.

The present compilation of research studies on the Revised ITPA was summarized by the undersigned and Nancy Stiefel, graduate assistant. By perusing journals and dissertation abstracts it is hoped that most of the studies from 1970 to April 1972 have been located. The reviews have been organized by topics and numbered 1A, 2A, 1B, 2B, etc., so that additional reviews can be appropriately inserted in the manuscript as they become available without changing pagination. The undersigned is indebted to Nancy Stiefel for the care in summarizing most of the studies, and to Toni Simons for the tedious stenographic work.

Samuel A. Kirk
University of Arizona
May 1972

Table of Contents

Page

Studies Comparing the Original and Revised Editions

Hubschman, Polizzotto, and Kaliski A-1

Studies Relating the ITPA to Other Tests

Huizinga B-1
Guest B-3
Polley B-5
Paletz and Hirshoren B-6

Screening, Prediction, and Diagnosis Studies

Smith C-1
Crittenden C-3
Feldman C-4

Ethnic and/or Social Class Studies

Lombardi D-1
Kuske D-2
Caccamo and Yater D-3
Butts D-4
Wright D-5
Westinghouse Learning Corporation D-7
Jorstad D-9
Michaelson D-11
Nurcombe and Moffitt D-12

School Achievement Studies

Reading: Macione E-1
Ruhly E-3
Celebre E-4
Golden and Steiner E-5
Ikeda E-6
Lagerman E-7
Bartin E-9
Guthrie and Goldberg E-11
Merlin E-13
Deese E-14

Spelling: Bannatyne and Wichiarojote F-1
Zbinden F-3

Remediation Studies

Moffitt et. al. G-1
Sandargas, Madsen, and Thompson G-3
Lavin G-5

Other Studies H-1

Hubschman, Eva, Polizzotto, Emilia Ann, and Kaliski, Myra S. Performance of institutionalized retardates on the PPVT and two editions of the ITPA. American Journal of Mental Deficiency, 74(January, 1970): 579-80.

Purpose

This study compared the performance of institutionalized female retardates on three tests: the experimental ITPA, the revised ITPA, and the Peabody Picture Vocabulary Test.

Subjects

The subjects were 53 female residents of a New Jersey institution for the mentally retarded with IQ's ranging from 22 to 66 (mean, 42.4) and CA's ranging from 7-10 to 20-7 (mean, 13-11).

Procedure

The experimental ITPA was given in 1968 and again a year later along with the revised ITPA and the PPVT. The latter administrations of the ITPA were given by two speech pathologists in separate sessions. A third speech pathologist administered the PPVT.

Results

1. High correlations were found on all three measures:

Experimental ITPA 1 and Experimental ITPA 2	.95
Experimental ITPA 2 and Revised ITPA	.93
Experimental ITPA 2 and PPVT	.71
Revised ITPA and PPVT	.73

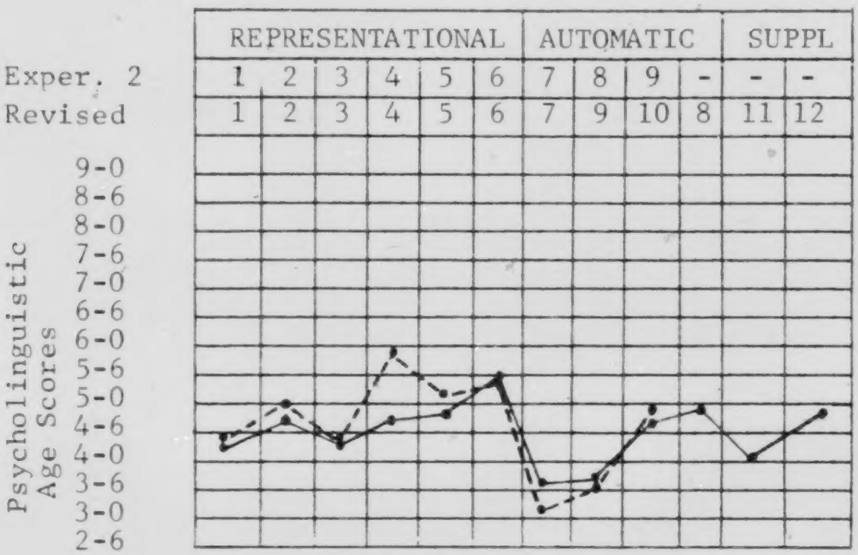
2. The "t" tests of correlated means (performed on the same comparisons as listed above) revealed only one significant difference, that being between Experimental ITPA 1 and Experimental ITPA 2. This significant difference reflects the language development of the subjects during the year interval between administrations of the experimental ITPA.

3. The profiles of mean scores for the two editions of the ITPA are strikingly similar (see Figure A-1) with the only real deviation being on the Visual Association subtest where there is a 15 month psycholinguistic language age difference in favor of the experimental edition.

Comments

These correlations did not partial out the CA and the IQ variables, which could account for the extremely high correlation between the experimental and revised editions.

Figure A-1. Mean scores of 53 institutionalized retardates on the subtests of the experimental and revised editions of the ITPA.



SUB-TEST	EXPERIMENTAL EDITION	REVISED EDITION
1	Aud. Decoding	Aud. Reception
2	Vis. Decoding	Vis. Reception
3	Aud-Voc. Assoc.	Aud. Association
4	Vis-Motor Assoc.	Vis. Association
5	Vocal Encoding	Verbal Expression
6	Motor Encoding	Manual Expression
7	Aud-Voc. Automatic	Grammatic Closure
8	Aud-Voc. Seq.	Visual Closure
9	Vis-Motor Seq.	Aud. Sequential Memory
10		Vis. Sequential Memory
11		Aud. Closure
12		Sound Blending

----- Experimental Edition Scores

_____ Revised Edition Scores

Huizinga, R.J. The relationship of the Illinois Test of Psycholinguistic Abilities to the Stanford-Binet Form L-M and the Wechsler Intelligence Scale for Children. Unpublished doctoral dissertation, University of Arizona, 1971.

Purpose

This study examined the concurrent validity of the revised edition of the ITPA by determining the relationship of ITPA measures to the Stanford-Binet scores and to the WISC scores.

Subjects

One hundred six-year-olds (50 boys and 50 girls) from a public school district of Tucson, Arizona, served as subjects. The school district was characterized as lower-middle to middle socio-economic class, predominantly Caucasian with approximately 10% Mexican-American representation.

Procedure

Three certified school diagnosticians administered to each of the subjects the revised ITPA, the Stanford-Binet Form L-M, and the WISC in a counter-balanced order of presentation. A correlational analysis of the results was made.

Results

1. Table B-1 presents the correlations among the scores on the ITPA, Stanford-Binet, and WISC.

Table B-1. Correlations of the global measures of the ITPA, the Stanford-Binet Form L-M, and the WISC.

	Stanford-Binet		WISC		
	MA	IQ	VS	PS	FS
ITPA					
Composite PLA	.89				
Total Scaled Score		.88	.75	.58	.80
Ratio PLQ		.90	.76	.55	.80
Estimated Binet MA	.90				
Stanford-Binet Form L-M					
IQ			.80	.57	.84

2. Table B-2 presents the relationships among the ITPA dimension scores, and the Stanford-Binet and WISC scores.

Table B-2. Correlations of the ITPA channels, levels, and processes with the Stanford-Binet Form L-M and the WISC.

	Stanford-Binet	WISC		
	IQ	VS	PS	FS
Channels				
Auditory-Vocal PLQ	.84	.74	.42	.71
Visual-Motor PLQ	.69	.56	.54	.66
Levels				
Representational PLQ	.86	.77	.47	.76
Automatic PLQ	.68	.49	.51	.59
Processes				
Reception PLQ	.72	.64	.42	.64
Association PLQ	.75	.71	.40	.68
Expression PLQ	.60	.52	.34	.53

3. Auditory Association is the ITPA subtest which best correlates with the Stanford-Binet IQ (.71), the WISC verbal IQ (.70), and the WISC full scale IQ (.62). The ITPA subtests which correlate highest with the WISC performance IQ are Visual Reception (.45) and Visual Association (.45).

4. The standard error of estimating the Stanford-Binet IQ from the ITPA Ratio IQ is 5.61 IQ points; the standard error of estimating the WISC full scale IQ from the ITPA Ratio IQ is 6.68 IQ points.

5. Intercorrelations of subtest scores of the WISC and the ITPA are available in the dissertation.

Comments

This study applies only to six-year-old children and should not be generalized to other age groups. Similar studies are needed for other age levels and on other populations.

Guest, Kristin E. Relationships among the ITPA, receptive and expressive language tasks, intelligence, and achievement. Unpublished doctoral dissertation, University of Wisconsin, 1970.

Purpose

This study examined the relationships among the ITPA, selected expressive and receptive criterion language tasks, intelligence, and school achievement for the purpose of finding duplication and overlap in measurement instruments of language and of intelligence.

Subjects

Forty-seven kindergarten Caucasion children (29 boys and 18 girls) from the public schools of Sauk-Prairie, Wisconsin, a semi-rural community, constituted the sample.

Procedure

The subjects were given the revised ITPA and the Wechsler Preschool and Primary Scale of Intelligence (WPPSI) during their kindergarten school year. During their first grade school year, the subjects were evaluated on Criterion Communicative Effectiveness tasks which included both expressive and receptive language tasks with each of four persons (another child, mother, teacher, and examiner). This battery of tasks was a combination of tasks used by linquists and psycholinguists in previous language studies plus some tasks created by the investigator. The Stanford Achievement Test, Primary I, was administered at the end of first grade.

Data were subjected to correlational analysis and multiple regression analysis.

Results

1. Total ITPA score was significantly related to WPPSI Verbal IQ (.69), to Performance IQ (.47), and to Full Scale IQ (.67).

2. Total Communicative Effectiveness Score (CES), which was a combination of Receptive Language Score (RLS) and Expressive Language Score (ELS), also related significantly to WPPSI Verbal IQ (.64), to Performance IQ (.44), and to Full Scale IQ (.63).

3. Total ITPA score was significantly related to total CES (.61), but there was no real relationship between ELS and the expressive subtests of the ITPA (.28) and only a moderate relationship between RLS and receptive subtests of the ITPA (.43).

4. Intelligence, total ITPA score, and total CES score were all significantly related to school achievement as follows:

Total ITPA and Total Achievement	.47
WPPSI Full Scale IQ and Total Achievement	.73
Total CES and Total Achievement	.52

5. Auditory Association (.48), followed by Grammatic Closure (.36) and Auditory Memory (.36), were the best predictors of total achievement.

6. Of the ITPA subtests, Auditory Association (.58), Auditory Reception (.50), and Grammatic Closure (.46) correlated most highly with WPPSI Full Scale IQ.

7. The Grammatic Closure subtest correlated as highly with CES (.63) as did total ITPA score (.61); Auditory Association correlated second highest with CES (.61).

Comments

Correlations between ITPA and WPPSI scores were not as high as those in Huizinga's study correlating ITPA and WISC but were higher than the Polley study correlating ITPA and WISC. Visual sequential memory, which showed high correlations with reading in previous studies, was relatively low in this study.

Polley, D. The relationship of the channels of communication of the ITPA and the WISC. Unpublished Ed. D. dissertation, University of Northern Colorado, 1971.

Purpose

This study sought to determine the degree of relationship between the ITPA scores and the verbal and performance scales of the WISC.

Subjects

The 160 subjects, grades one through three, were selected from those students referred to Special Services of Adams County (Colorado) Public Schools because of suspected or indicated learning disability. Mean CA was 8-0 with a range from 6-1 to 10-1. Race, creed, sex, and intelligence were disregarded in sample selection.

Procedure

All subjects were given the ITPA and the WISC within a two week period. Inter-correlations were calculated for all subtests and for part and total scores of each test. Group means and standard deviations were calculated to compare subjects of this study to the normative populations of the two tests.

Results

The following correlations were derived:

Sum of ITPA scaled scores and WISC full scale IQ	.49
Auditory-Vocal channel of ITPA and WISC verbal IQ	.28
Visual-Motor channel of ITPA and WISC performance IQ	.20
WISC verbal IQ and WISC performance IQ	.65
ITPA Auditory-Vocal channel and ITPA Visual-Motor channel scores	.72

Comments

The low correlations between the WISC and ITPA scores found in this study is at variance with the results of Huizinga and of Guest. The only explanation for these low correlations might be surmized by the fact that the subjects of this study had a mean CA of 8-0 and a range of 6-1 to 10-1. Since a substantial proportion of the subjects must have scored at the top of the standardization norms, it is very likely that this fact could possibly produce a low correlation.

Paletz, D. and Hirshoren, A. A comparison of two tests of visual sequential ability. Journal of Learning Disabilities, 5 (February, 1972): 102-103.

Purpose

This study compared the revised ITPA Visual Sequential Memory subtest and the Knox Cube Test to determine if they measure the same memory ability.

Subjects

The subjects for this study were 96 elementary school children from Urbana, Illinois. The population from which these children were drawn and the age ranges represented were similar to those of the 1968 ITPA standardization sample.

Procedure

The ITPA subtest and the Knox Cube Test were given to four groups of 24 children each (12 boys and 12 girls) in kindergarten, 2nd, 4th, and 6th grades. The administration of the two tests was counterbalanced in each grade level sample. Correlations between the two test scores were run separately for each group.

Results

The correlations between the two tests were as follows:

for kindergarten children	.57
for 2nd grade children	.17
for 4th grade children	.08
for 6th grade children	.22

The authors conclude that the low value of the above correlations seems to indicate that the two measures do tap different abilities.

Comments

A similar study was conducted by Stark (1967) comparing the Knox Cube Test, the experimental ITPA Visual-Motor Sequencing subtest, and the experimental ITPA Auditory-Vocal Sequencing subtest with aphasic children with a mean CA of 6-6. The correlation between the Knox Cube Test and the Visual-Motor Sequencing subtest was .41. Comparing these results and the present study, it may be that these two tests are related only for young children.

Smith, Joan M. Utilization of the Illinois Test of Psycholinguistic Abilities with educationally handicapped children. Unpublished Ed. D. dissertation, University of the Pacific, 1970.

Purpose

This study attempted to determine the value of the revised ITPA in identification, diagnosis, placement, and program development for children with educational handicaps. Three specific questions were asked: (1) do EH children have learning modality deficiencies as measured by the ITPA when compared with the children from the normative population? (2) are there differences in the learning modality abilities of EH students related to sex? (3) do highly verbal EH boys differ in their profiles from those who were performance skilled?

Subjects

Subjects were 74 children with normal intelligence enrolled in the program for the Educationally Handicapped in the San Juan Unified School District, Carmichael, California, who exhibited a significant discrepancy between ability and achievement. These children ranged in CA from 7-3 to 10-3 and exhibited no identified sensory handicaps such as severe hearing, speech, sight, or physical disabilities. Mean group IQ was 96.7. These children were perfoming in school a minimum of two years below their ability level.

Procedure

All subjects were given the ITPA; WISC scores were available for the boys. Statistical analysis was by means of "t" tests.

Results

1. The performance of the EH subjects was significantly poorer than the normative population (at least at the .05 level) on the following subtests: Auditory Closure, Auditory Reception, Verbal Expression, Grammatic Closure, Visual Memory, Visual Association, Visual Closure, and Auditory Association. These deficiencies among the EH students are not confined to either the representational or the automatic level.

2. On Sound Blending subtest, the EH subjects significantly (.001 level) out performed the normative population with a mean scaled score of 40.4.

3. There were no differences noted between the girls' and the boys' performance on the ITPA.

4. Verbally-skilled boys (defined as the WISC verbal IQ score exceeding the performance IQ score by 15 points) scored significantly higher on Grammatic Closure (.02 level), Auditory Closure (.05 level), and Sound Blending (.01 level) than the performance-skilled boys (defined as the WISC performance IQ score being 15 points higher than the verbal IQ score); the latter scored significantly higher on Visual Closure (.02 level).

Comments

The subjects in this study were children at the nine year level who typically score at the top of the norms, thus restricting the standard deviation of the group data. It would have been more enlightening if younger children had been used in this type of study.

The differences found between this sample of educationally handicapped children and the standardization population were probably influenced by the below average intellectual level of this sample as represented by a lower than average IQ. Such differences might not have been as great if the intellectual factor had been controlled or partialled out.

Crittenden, J. B. An empirical investigation of the behavioral dimensions of four tests of learning disabilities. Unpublished doctoral dissertation, Michigan State University, 1969.

Purpose

The purpose of this study was to identify the dimensions which underlie four tests used for diagnosis and remediation of learning disabilities for the purpose of reducing the diagnostic process.

Subjects

Subjects were 305 disadvantaged kindergarten children.

Procedure

All subjects were given the revised edition of the ITPA, the Frostig Developmental Test of Visual Perception, the Wepman Auditory Discrimination Test, and the Purdue Perceptual Motor Survey. Data were submitted to Principal Axis Factor Analysis with Varimax Rotation. Two-way analysis of variance and multiple regression analyses were also run. The framework for hypothesizing the factor structure came from Guilford's Structure of Intellect model and his Matrix of Psychomotor Abilities.

Results

1. The factorial nature of the revised ITPA was best represented by three dimensions described by Guilford and related to individual subtests as follows:

Visual Reception - Cognition of semantic relations
Verbal Expression - Convergent production of semantic relations
Auditory Sequential Memory - Memory for symbolic systems

2. The four subtests which appeared to best predict IQ were Auditory Association, Auditory Sequential Memory, Grammatic Closure, and Spatial Relations (Frostig).

Comments

Reference should also be made to the Feldman study herein abstracted.

Feldman, B. Prediction of first grade reading achievement from selected structure of intellect factors. Unpublished doctoral dissertation, University of Southern California, 1969.

Purpose

This study was concerned with testing the criterion validity of Guilford's Structure of Intellect by predicting first grade reading achievement from identified SOI factors.

Subjects

Subjects were 196 first graders from a California school system.

Procedure

Subjects were given, in the fall of the school year, a battery of 21 tests, including three revised ITPA subtests, which were submitted to a factor analysis to select predictive SOI factors. The following spring the subjects were given reading tests, and a stepwise multiple regression was run.

Results

1. Memory of Figural Units - Visual and Memory of Figural Units - Auditory proved to be the best predictors of reading, followed by Evaluation of Figural Units - Auditory, then Cognition of Semantic Units, and then Cognition of Figural Units - Auditory.

2. Correlations between the three ITPA subtests administered and the SOI factors were as follows:

Auditory Closure and Cognition of Figural Units - Auditory	.43
Auditory Closure and Evaluation of Figural Units - Auditory	.42
Sound Blending and Cognition of Figural Units - Auditory	.58
Auditory Sequential Memory and Memory of Figural Units - Auditory	.83

Comments

The correlations between the SOI factors and the ITPA subtests are not surprising since they are dealing with similar functions. Reference should also be made to the Crittenden study herein abstracted.

Lombardi, T. P. Psycholinguistic abilities of Papago Indian children. Exceptional Children, 36, (March, 1970): 485-94

Purpose

This study investigated the psycholinguistic abilities of Papago Indian school children in integrated and segregated first and third grades.

Procedure

The revised ITPA was administered to a stratified random sample of 80 Papago children who were selected from a 70 mile radius of Tucson, Arizona. Half of the subjects were in the first grade and half in the third grade; an equal number were in integrated and segregated schools. Data were analyzed by a comparison of mean scaled scores using "t" tests.

Results

1. The Papago group scored significantly below the standardization group (.01 level) on the ITPA composite psycholinguistic age score and on 11 subtests.

2. The Papago children were significantly superior to the standardization group (.05 level) on the Visual Sequential Memory subtest.

3. Papagos as a group revealed deficits in the auditory-vocal channel as demonstrated by an intra-profile analysis.

4. A comparison of the first and third grade Papago group indicated no significant differences on the ITPA composite PLA scores and on 10 of the subtests. The first graders were significantly superior to the third graders (.01 level) on Auditory Reception and Grammatic Closure.

5. The subjects from integrated schools performed better than those from segregated schools (.05 level) on composite PLA score and on seven of the subtests, five of which were at the representational level.

Comments

The auditory-vocal channel deficit is not surprising since the Papagos are a bilingual ethnic group.

The fact that the first graders performed better than third graders on two auditory-vocal subtests make one question the efficacy of their school instruction in language. The fact that those subjects attending integrated schools performed better on seven out of twelve subtests seems to indicate that contact with English speaking peers is helpful to their psycholinguistic development as measured by the ITPA.

Kuske, I. I., Jr. Psycholinguistic abilities of Sioux Indian children
Unpublished doctoral dissertation, University of South Dakota, 1969.

Purpose

The purpose of this study was to compare the psycholinguistic responses of mentally handicapped Sioux children, non-mentally handicapped Sioux children, mentally handicapped Caucasian children, and the standardization population of the revised ITPA.

Subjects

Three groups of children, 50 mentally handicapped Sioux, 50 non-mentally handicapped Sioux, and 50 mentally handicapped non-Indian, were selected from South Dakota public schools. The mentally handicapped groups were matched on the basis of MA, CA, IQ, sex, and rural-urban environment. These were matched with the ITPA normative population and non-mentally handicapped Sioux group on the basis of MA. Ethnic membership required at least 25% Sioux blood. All mentally handicapped subjects were selected from special education classes.

Procedure

The revised ITPA was administered to each subject. Inter-group raw score comparisons, using "t" tests, were made among the three research groups and between the groups and the normative population. Intra-group profile analyses were made to determine psycholinguistic pattern similarities among the groups.

Results

1. Non-mentally handicapped Sioux children's performance was significantly inferior (.05 level) to the normative population on all but Visual Closure and Sound Blending subtests.

2. Matched for MA, the mentally handicapped Sioux children performed significantly better than the non-mentally handicapped Sioux children on Visual Association and Visual Sequential Memory subtests.

3. Mentally handicapped Sioux children performed significantly better than did the mentally handicapped non-Indian children on Visual Association, Visual Closure, Visual Sequential Memory, and Sound Blending subtests.

Comments

The inferior performance of Sioux children as compared to the normative population is similar to the results of Lombardi on Papago children. This study does not show, however, the superiority in Visual Sequential Memory as do the studies of Lombardi and Garber.

Caccamo, J. M. and Yater, A. C. The ITPA and Negro children with Down's syndrome. Exceptional Children, 38 (April 1972): 642-43.

Purpose

This study investigated whether the ethnic superiority of Blacks in short-term auditory sequential memory found in other research studies would be observed in exceptional Negro children.

Subjects

The sample consisted of Negro children with Down's syndrome.

Procedure

The revised ITPA was administered to each subject. A "t" test comparison of means was used to analyze the data for each subtest and for the channels and processes dimensions of the test.

Results

1. No significant difference was found between this sample's performance on the Auditory Sequential Memory subtests and performance on the other subtests.

2. This sample's performance on the Manual Expression subtest was significantly superior to their performance on all other subtests except Visual Closure.

3. Subtests comparison by channel indicated that visual-motor performance was significantly superior for the processes of reception, expression, and closure. The processes of association and sequential memory were not statistically significant but also showed a preference to the visual-motor channel.

Comments

These results of no superiority in auditory sequential memory differ from the findings of Ryckman (1966), Bateman (1964), Cicarelli (1969), and Westinghouse Learning Corporation (1969). The high performance in manual expression of this sample, however, is in harmony with studies of Caucasian children with Down's syndrome (McCarthy). Apparently, Negro children with Down's syndrome perform more like Caucasian children with Down's syndrome than like non-Down's syndrome Negro children.

Butts, T. M. A study of race and social class variables and psycholinguistic, cognitive, and perceptual measures of selected first grade children. Unpublished doctoral dissertation, University of Alabama, 1970.

Purpose

This study attempted to determine if significant differences exist between four urban cultural groups (middle class white, lower class white, middle class black, lower class black) on 12 psycholinguistic and three visual perceptual measures.

Subjects

Forty-eight first grade children from six elementary schools in Huntsville, Alabama, were divided into four groups matched on intellectual level, CA, educational status, sex, race, and social class. Range of IQ scores was 84-116 as measured by Slosson Intelligence Test. Socio-economic status was assessed by McGuire White Social Status Index, Short Form.

Procedure

All subjects were individually examined by trained examiners on 12 subtests of the revised ITPA and on 3 areas of the Cross Cultural Study of Perception (CCSP). Two way analysis of variance was used; .05 was selected as the level of significance. Ancillary data were obtained by computing a correlation matrix among all subtests.

Results

A comparison of four groups of 12 subjects each indicated that (1) middle class whites were significantly superior in Visual Reception, Visual Closure, Auditory Closure, and Auditory Association to middle class blacks, lower class blacks, and lower class whites; (2) in auditory sequential memory the middle class blacks were significantly superior to lower class whites and lower class blacks, and although the mean raw score for MCB's was 34.5 compared to 29.67 for the MCW's, this difference was not statistically significant; (3) middle class whites were significantly superior on visual sequential memory to lower class blacks and to lower class whites, but middle class blacks were also significantly superior to lower class whites.

Comments

The results of this study confirm other studies on class and race differences on the ITPA. The small N of 12 for each group, however, makes the results tentative. All four groups scored above the norms on the Visual Sequential Memory subtest.

Wright, L. S. Perceptual and cognitive characteristics and their relationship to social factors and academic achievement in third grade conduct problem boys. Unpublished Ed.D. dissertation, University of Illinois, 1969.

Purpose

This study investigated selected perceptual and cognitive characteristics of 3rd grade boys referred by their teachers as having conduct problems, and determined how social and economic factors and academic achievement interrelate with those perceptual and cognitive characteristics.

Subjects

Subjects were forty-seven 3rd grade boys, referred by experienced teachers in a midwest city school system as children whom they considered to be moderate to severe conduct problems on characteristics taken from the Quay and Peterson Behavior Problem Checklist.

Precedure

All subjects were administered the following tests by qualified examiners: Bannatyne Visuo-Spatial Memory Test, Graham-Kendall Memory for Designs Test, Wepman Auditory Discrimin ation Test, revised ITPA, WISC Vocabulary subtest, California Short Form test of Mental Maturity, and the Iowa Test of Basic Skills. Reading achievement was determined by the Reading Comprehension subtest of the Iowa Test of Basic Skills, and a reading performance index was computed for each subject. Statistical analyses included product moment correlations, one way and repeated measures analyses of variance, and chi square median tests.

Results

1. On the ITPA, this sample of conduct problem boys scored significantly below (.05 level) the normative population on Grammatic Closure, Visual Memory, Verbal Expression, and Auditory Reception, and scored significantly above (.05 level) on Sound Blending.

2. The working class Negro group scored significantly below the normative population on all the subtests of the ITPA except Auditory Memory.

3. No significant correlations were found for either the Negro or White subjects between achievement and performance on the Bannatyne, the Graham-Kendall, or the Wepman tests. For the Negro subjects the following positive correlations between achievement (Iowa Test of Basic Skills) and ITPA subtests were statistically significant:

Language Usage and Auditory Memory	$r = .46$
Reading and Manual Expression	$r = .52$

4. There were many significant positive correlations between achievement and ITPA subtests for White subjects.

Comments

The fact that this sample scored significantly better than the ITPA normative population on Sound Blending is probably due to the fact that the phonics approach to reading was taught in this school system. It should be noted, however, that in Smith's study, educationally handicapped subjects also scored higher than the standardization population on the Sound Blending subtest.

The fact that Auditory Memory was the one subtest on which the working class Negro subjects did not perform significantly poorer than the ITPA normative population is in keeping with other research on ethnic group profiles on the ITPA. Ten Negro subjects had psycholinguistic strengths on subtests in the automatic level, but only 4 had strengths at the representational level; the only deficits at the automatic level were on Grammatic Closure subtest. These results appear supportive of Arthur Jensen's notion of Type 1 abilities in ethnic group children.

The general lack of significant relationships between academic achievement for the Negro subjects and performance on the other measures suggest that for them other variables are more important to achievement than those investigated in this study.

Westinghouse Learning Corporation and Ohio University. The impact of Head Start, 1969.

Purpose

The purpose of this abstract is to study the ethnic differences in psycholinguistic abilities as extracted from the data of the Westinghouse study.

Procedure

The precedure for this abstract was to extract from the data of the Headstart study the psycholinguistic profiles of different ethnic groups of children who were tested with the ITPA at the age of 7-5 while enrolled in the second grade.

Results

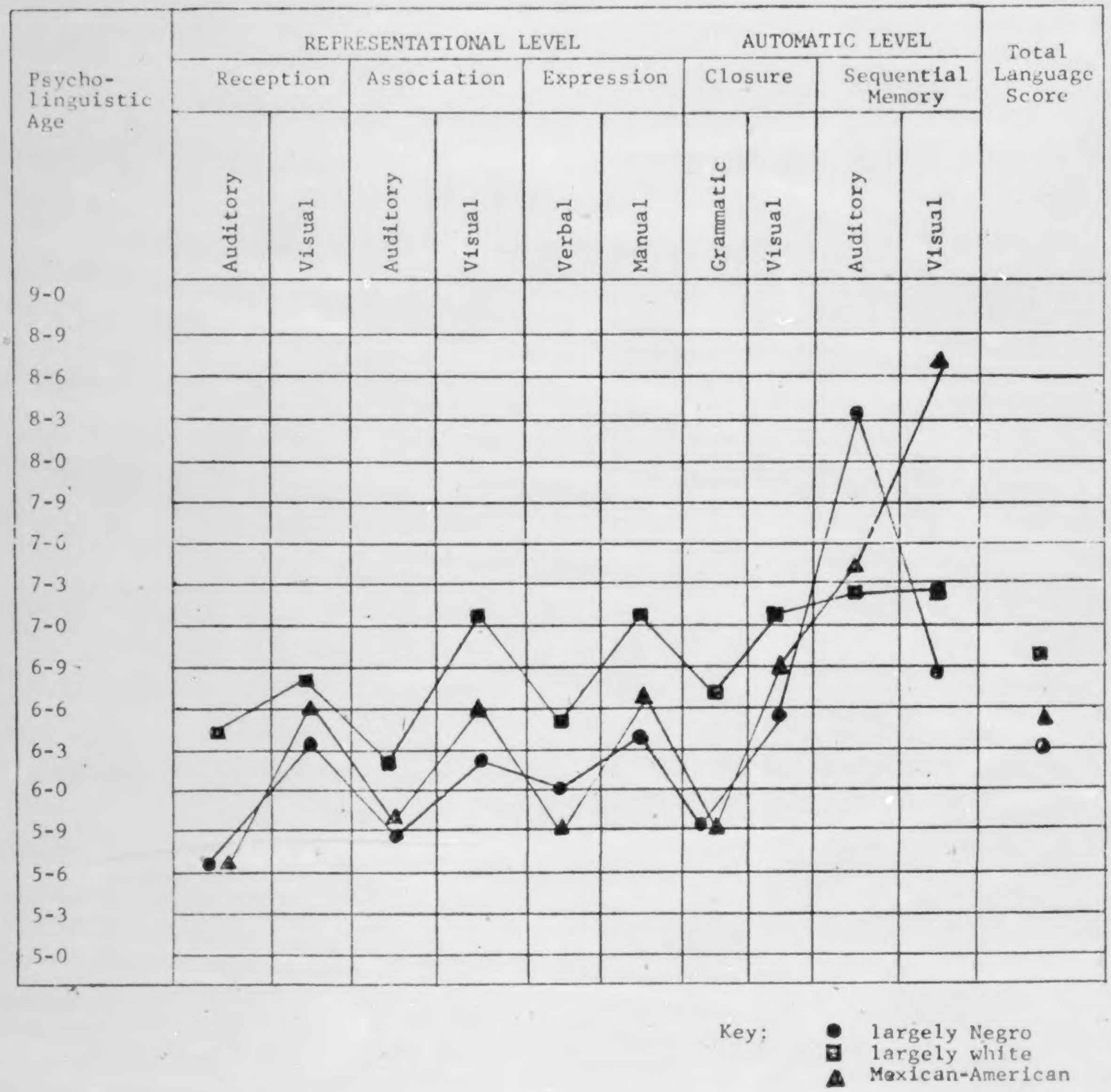
1. The Head Start children from both summer and full year programs scored highest on Auditory Sequential Memory subtest (Scaled Score of 37), Visual Sequential Memory (SS of 35), and Manual Expression (SS of 35). They scored lowest on Auditory Association (SS of 28), Auditory Reception (SS of 30), and Grammatic Closure (SS of 30).

2. An analysis of Figure D-1 which shows psycholinguistic profiles by ethnic group membership reveals that (1) the Anglo children's memory scores were comparable to their other subtest scores; (2) the Black children scored very high in auditory sequential memory--higher than their own scores on other subtests and higher than the auditory memory scores of Anglos and Mexican-American children; (3) the Mexican-American children scored highest on Visual Sequential Memory subtest--higher than their other subtests and higher than the other ethnic groups.

Comments

These results are in keeping with the other studies on psycholinguistic differences among ethnic groups. For the Black children, their Visual Sequential Memory score was the lowest of the ethnic groups being compared but was still higher than most of their other subtest scores which appears to be in keeping with Arthur Jensen's hypothesis that Blacks perform well on Type I activities of rote memory.

Figure D-1. ITPA profiles of Head Start children from summer programs at grade two (age 7-5) for subgroups of centers according to racial-ethnic composition.



Jorstad, Dorothy. Psycho-linguistic learning disabilities in twenty Mexican-American students. Journal of Learning Disabilities, 4 (March 1971): 143-49.

Purpose

This study presented a composite ITPA profile from the scores of Mexican-American students having reading difficulties.

Subjects

The subjects were twenty disadvantaged Mexican-American students from Coachella (California) School District whom reading specialists referred to the author as having unusual problems that needed further diagnosis. The average CA was 8-1.

Procedure

The revised ITPA was administered to each of the subjects, and results were compiled as one composite profile.

Results

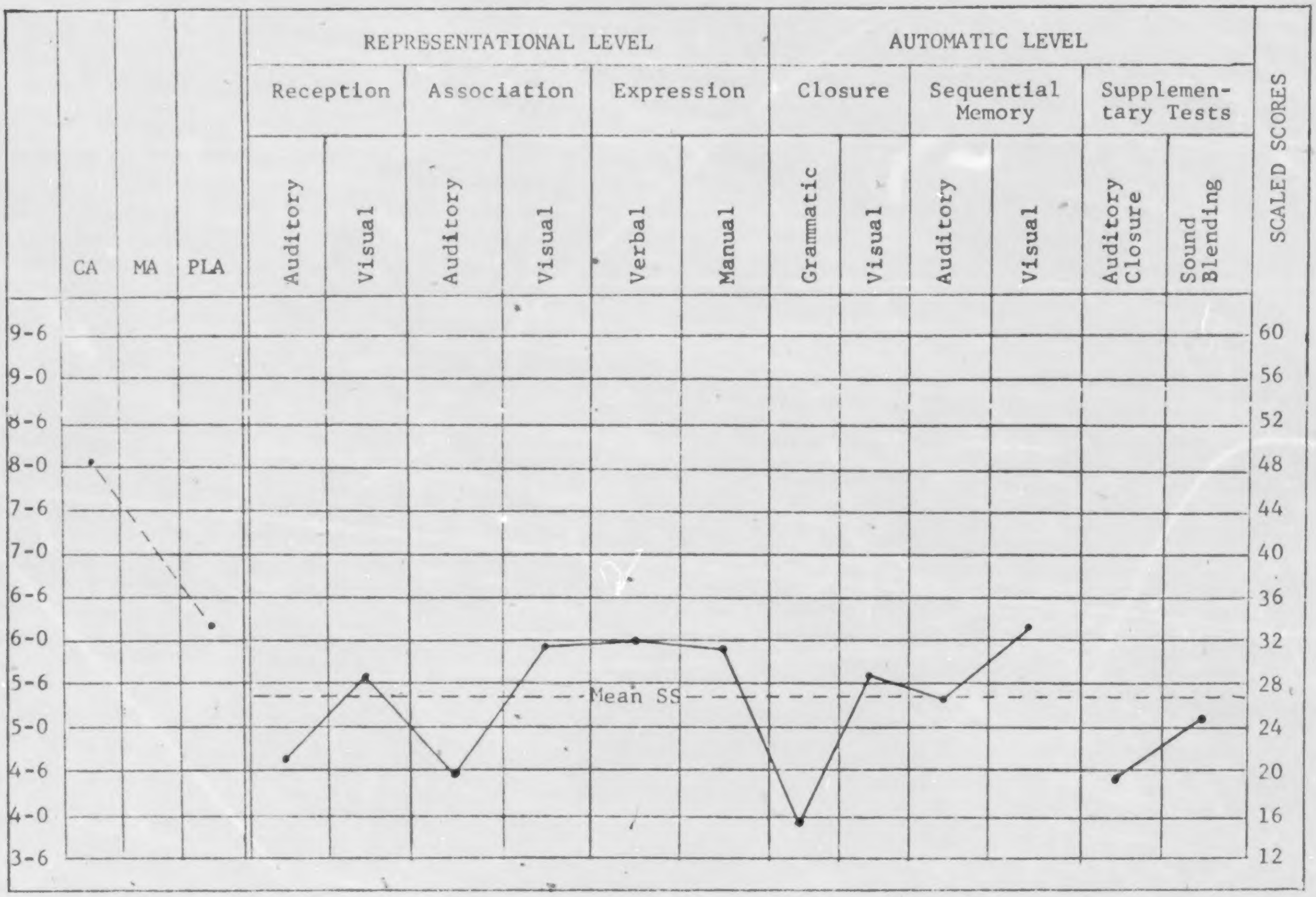
Figure D-2 presents the profile for the twenty Mexican-American children with reading retardation. It will be noted from this profile that (1) the mean Scaled Score of 27 is significantly below the standardization norms, (2) the auditory-vocal channel is inferior to the visual-motor channel, and (3) the Visual Sequential Memory subtest is the highest of the scores.

Comments

The profile of Mexican-American children is typical of bilingual children, showing an auditory-vocal channel disability as compared to the visual-motor channel functions.

The disadvantaged Mexican-American children's profile for 7-5 year olds (The Impact of Headstart, Westinghouse Learning Corp.) is similar to this profile except for a much lower Verbal Expression score.

Figure D-2. A composite ITPA profile in scaled scores of Mexican-American students, aged 8-1.



Michaelson, Anne W. Psycholinguistic differences of monolingual and bilingual culturally-deprived children. Unpublished Master's thesis, Colorado State University, 1970.

Purpose

This study attempted to determine whether the psycholinguistic abilities of bilingual children from culturally-deprived homes differ from the psycholinguistic abilities of monolingual children from the same type of home.

Subjects

The sample consisted of ten bilingual (Spanish and English) and ten monolingual culturally deprived pre-school children enrolled in Head Start programs in Ft. Collins, Colorado. The bilingual group consisted of six girls and four boys with a mean CA of 59.6 months. The monolingual group was composed of seven girls and three boys with a mean CA of 59.3 months. All the children had normal hearing, vision, and IQ. Children with severe motoric difficulties and severe articulation problems were eliminated from the study.

Procedure

Each child was administered the revised ITPA. Data were analyzed by "t" tests.

Results

1. The bilingual group scored significantly below the monolingual group (.05 level) on two out of ten subtests (Auditory Association and Auditory Sequential Memory) and on the auditory-vocal channel of communication.

2. The lowest subtest mean scaled scores for bilingual subjects were Auditory Association (30.6) and Grammatic Closure (30.8); for monolingual subjects they were Visual Memory (32.5) and Visual Association (34.4).

3. The highest subtest mean scaled score for both groups was Manual Expression (38.3 bilingual; 39.3 monolingual); the second highest for bilingual children was Visual Closure (37.7), and for the monolingual children the second highest was Visual Reception (37.5).

Comments

The lower auditory-vocal channel scores for the bilingual subjects are not surprising since we would assume that these subjects would have less mastery of English than the monolingual group, due to less exposure to English. All mean scaled scores for both bilingual and monolingual subjects were within average range of the standardization population.

Nurcombe, B. and Moffitt, P. Cultural deprivation and language defect: Project Enrichment of Childhood. Australian Psychologist, 5 (November 1970): 249-59.

Purpose

This study evaluated the psycholinguistic functioning of Australian Aboriginal children and European children enrolled in an experimental preschool intervention program.

Subjects

Thirty-six children--18 Aboriginal and 18 European--from an Australian rural setting (Bourke, New South Wales) constituted the sample. The mean age at the time of testing was 43 months with a range of 36 to 48 months.

Procedure

All subjects were administered the revised ITPA, Form A of the PPVT, and the Vocabulary and Geometric Design subtests of the WPPSI. Group mean scaled scores were compared by "t" tests.

Results

1. For the Aboriginal group the three subtests of Visual Closure, Auditory Sequential Memory, and Visual Sequential Memory fall within the normal range, while major deficits appear in Auditory Association, Visual Association, Manual Expression, Grammatic Closure, and Auditory Reception subtests.

2. The Aboriginal group scored significantly below the European group on eight subtests of the ITPA (all but Visual Closure and Auditory Sequential Memory). They were also significantly below the European group on the two WPPSI subtests.

Comments

The Aboriginal group appeared to be higher on the automatic level subtests than on the representational level subtests, the opposite of what is found in a mentally retarded population.

Macione, J. Psycholinguistic correlates of reading disabilities as defined by the Illinois Test of Psycholinguistic Abilities. Unpublished doctoral dissertation, University of South Dakota, 1969.

Purpose

The purpose of this investigation was to determine differences in psycholinguistic abilities as measured by the ITPA between disabled and non-disabled readers.

Subjects

Two groups of 28 disabled and 28 non-disabled boys in second and third grade were matched on scholastic aptitude, age, grade, and school attended. A disabled reader was defined as one retarded more than .5 of a year at the conclusion of grade 2 and more than .7 of a year at the conclusion of grade 3.

Procedure

The revised ITPA was administered to each subject in the two groups. Data were analyzed by "t" tests.

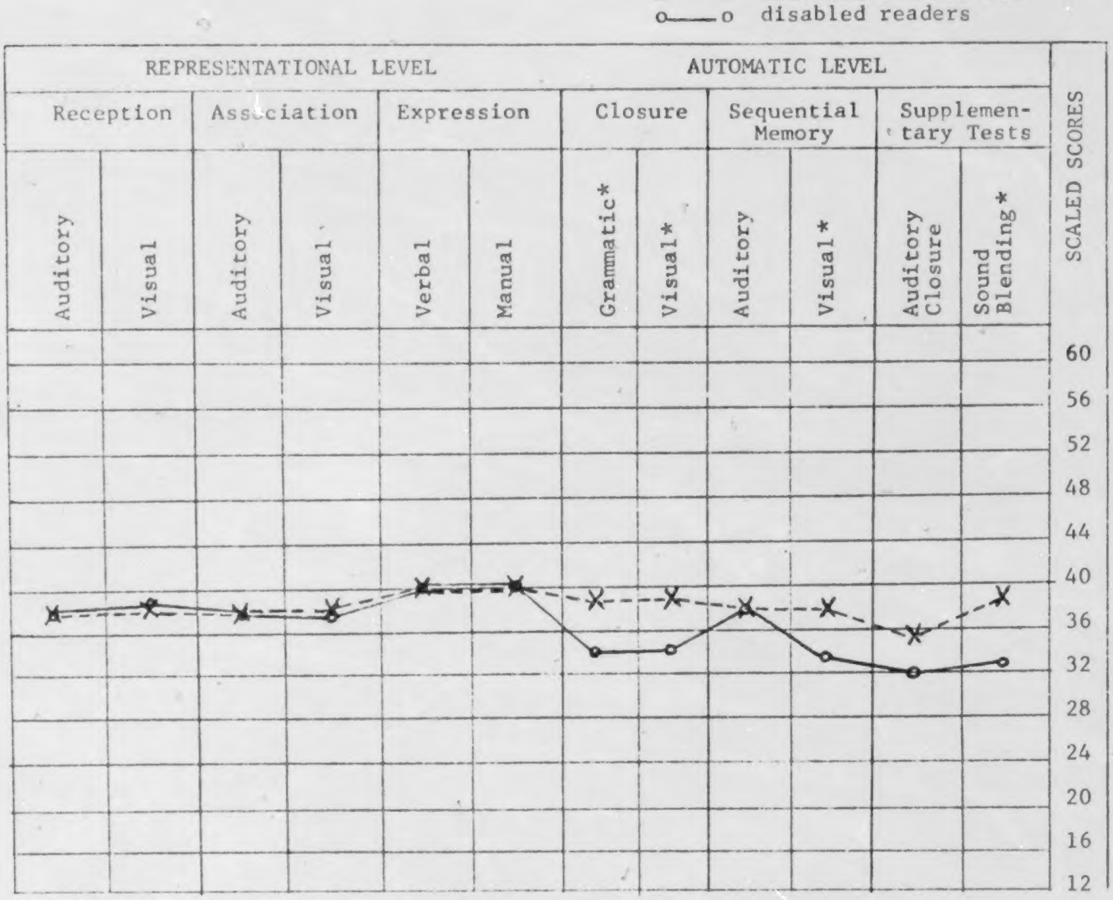
Results

The general pattern of psycholinguistic functions for the disabled readers was higher functioning at the representational level than at the automatic level. See Figure E-1. The disabled readers were significantly (.05 level) lower on 4 of the 6 subtests at the automatic level: Grammatic Closure, Visual Closure, Visual Sequential Memory, and Sound Blending.

Comments

These results are similar to those of Kass (1962) with the experimental edition of the ITPA, to Ruhly (1970), and to Celebre (1971) but not in agreement with Lagerman (1970) who found no differences between automatic and representational level performance.

Figure E-1. Profile of Scaled Scores for Disabled Readers and Non-disabled Readers.



* differences significant at the .05 level

Ruhly, Velma. A study of the relationship of self-concept, socioeconomic background, and psycholinguistic abilities to reading achievement of second grade males residing in a suburban area. Unpublished doctoral dissertation, Wayne State University, 1970.

Purpose

This study explored the relationship of reading achievement to socioeconomic background, reported self-concept, and psycholinguistic abilities.

Subjects

Subjects were 128 white male children in the 7th month of the 2nd grade in six elementary schools in Birmingham, Michigan.

Procedure

Each subject was administered (a) the Word Meaning and Word Study Skills from the Stanford Achievement Test, (b) Role Expectations, Self Adequacy, and Self-Concept subtests of the SCAMIN--Self-Concept and Motivation Inventory: What Face Would You Wear?, and (c) the revised Illinois Test of Psycholinguistic Abilities. Information as to parental education, father's occupation, and IQ (from SRA Test of Primary Abilities) was secured from school records. The subjects were divided into upper and lower fifty percent on the basis of their scores on the standardized reading test. Analysis of covariance design was used to remove, in turn, the effects of school, teacher, and tested intelligence.

Results

1. A significant difference was found between reported self-concept of the high and low readers in terms of role expectations with the low readers reporting greater role expectations. No significant difference was found between reported self-concept in terms of self-adequacy and total self-concept.

2. A significant difference was found between psycholinguistic abilities of high and low readers; auditory modality functioning and specific automatic language skills were significantly related to high achievement in reading.

3. No significant differences were found between high and low readers on the basis of parental education or father's occupation.

Comments

Other studies (Kass, 1962, Macione, 1969, Celebre, 1971) have revealed an automatic skill deficit in poor readers which seems to be a corollary to this study's finding that automatic language skills were significantly related to high achievement in reading.

Celebre, G. Psycholinguistic abilities and oral word recognition associated with relative level of personality adjustment in primary school-age children with minimal brain dysfunction. Unpublished Ed.D. dissertation, Temple University, 1971.

Purpose

This study investigated the degree to which relative level of personality adjustment accounted for common patterns of psycholinguistic abilities and word recognition skills in children as compared to the patterning accounted for on the basis of their diagnostic-educational placement.

Subjects

Subjects were 104 children, ranging in age from 8 through 10; 52 were in classes for learning disabilities or minimal brain dysfunction and 52 were in regular classes.

Procedure

All subjects were given the revised ITPA, the oral reading section of the WRAT, and the Neuroticism sub-scale of the Children's Personality Questionnaire. Multivariate analysis of covariance and stepwise regression techniques were used to test the hypotheses.

Results

1. Relative level of personality adjustment did not differentiate subjects in terms of either psycholinguistic functioning or oral word recognition skills.

2. Certain "nonconceptual" processing deficits, as reflected in Grammatic Closure, Auditory Closure, and possibly Sound Blending subtests, were important ITPA correlates of word recognition deficiencies.

3. Children in the learning disability group were significantly more deficient than the regular class controls in Auditory Association, Grammatic Closure, Auditory Closure, and Sound Blending subtests.

4. Knowledge of diagnostic-educational placement was a significant predictor of oral word recognition ability.

Comments

The "non-conceptual" or automatic processing deficits of poor word callers which the author refers to have also been found in other studies, namely, Kass (1962), Macione (1969), and Ruhley (1970).

Golden, Nancy E. and Steiner, Sharon R. Auditory and visual functions in good and poor readers. Journal of Learning Disabilities, 2 (September 1969): 476-81.

Purpose

This study attempted to determine the differences between high and low achieving readers of normal intelligence on six tests of specific visual and auditory functions.

Subjects

Subjects were twenty 2nd grade children (8 girls and 12 boys) from three Illinois cities with IQ's between 90 and 110 on the Stanford-Binet, a deviation of at least one year above or below mental age reading expectancy on measures of silent and oral reading, and no evidence of auditory or visual defects. The 20 subjects were matched by IQ, MA, and CA into 10 pairs, matching a good reader with a poor reader.

Procedure

Subjects were administered three auditory tests from the revised ITPA (Sound Blending, Auditory Sequential Memory, and Auditory Closure) and three tests of visual ability (the Monroe Visualization Test and the Visual Closure and Visual Sequential Memory subtests of the revised ITPA).

Results

1. The good readers were significantly superior (at least at .05 level) to the poor readers on Sound Blending, Auditory Sequential Memory, and the Monroe Visualization Test. The other subtests failed to differentiate between good and poor readers.

2. Significant intercorrelations included: Silent Reading: .60 with Sound Blending and .58 with the Monroe Visualization test; Oral Reading: .67 with Sound Blending and .77 with the Monroe Visualization Test.

Comments

This study with only 10 subjects in each group indicates that the Sound Blending subtest and the Monroe Visualization Test differentiate between good and poor readers. A larger N is needed for more conclusive results.

Ikeda, M. The relationships between the ITPA, reading performance, and IQ of third grade children. Unpublished doctoral dissertation, University of New Mexico, 1970.

Purpose

This study investigated the relationships between the ITPA, reading performance, and IQ of children in regular third grade classrooms.

Subjects

Fifty subjects regularly enrolled in the 3rd grades at Sandia Base School were selected by stratified random sampling.

Procedure

All subjects were administered the ITPA, PPVT, and Gates-MacGinitie Reading Tests, Primary C. The Bond and Tinker Reading Expectancy formula was used as a criterion to determine reading ability, which was classified as good, average, and poor. Results were analyzed by means of product-moment correlations, analysis of variance, and analysis of covariance utilizing the .05 level of probability.

Results

1. Good, average, and poor readers did not differ on the subtests of the ITPA or on the 3 dimensions of channels, processes, and levels of organization.

2. The subtests, Auditory Association, Grammatic Closure, and Sound Blending, correlated significantly with reading ability.

3. For each dimension, the following correlated significantly with reading ability: auditory-vocal channel, association process, and automatic level.

4. The PPVT MA did not correlate significantly with reading, but, as would be expected, the PPVT IQ correlated with Visual Reception, Auditory Reception, Verbal Expression, Grammatic Closure, Visual Memory, Sound Blending and total score.

Comments

Since normal 3rd grade children were used, it is possible that many of them reached the ceiling of the norms, thus effecting differences. One could also raise the question of whether differences among good and poor readers were large enough to bring out significant differences in psycholinguistic functions.

Lagerman, Audrey P. Psycholinguistic characteristics of children with reading disabilities and the effects of remediation of psycholinguistic development and reading achievement. Unpublished Ed.D. dissertation, Marquette University, 1970.

Purpose

This study had a two-fold purpose: (1) to determine if psycholinguistic disabilities at the nonsymbolic (automatic) level are more characteristic of children with reading disabilities than those at the symbolic (representational) level and (2) to determine the effectiveness of two programs of remediation on the reading achievement and psycholinguistic development of the sample of children with learning disabilities.

Subjects

Subjects were twenty-five children found to be reading at least one year below expected level and 15 children scoring at grade level; all 40 children were either 3rd or 4th graders.

Procedure

Subjects were administered the vocabulary and reading sections of the California Achievement Test and the WISC. The Bond and Tinker Reading Expectancy Formula was applied to determine expected reading level. Those 25 subjects found to be reading at least one year below expected reading level were also given the ITPA, and automatic level and representational level scores were compared by a "t" test.

Twenty-two of the above subjects exhibited deficits in psycholinguistic functioning. The second part of the study divided those 22 children into two treatment groups on the basis of sex and degree of disability. One group was given treatment based on their psycholinguistic deficits, while the other group was given treatment based on their reading skill deficits. The treatment groups met twice a week for a total of 50 minutes per week for four months. After the treatment period, the ITPA and reading achievement tests were re-administered. Sixteen analyses of variance were performed.

Results

1. There was no significant difference gound between the sample's automatic level psycholinguistic skills and their representational level psycholinguistic skills.

2. There were no significant differences found in the gains made the two groups in reading achievement or on the ITPA with the exception of the Auditory Reception subtest, and the gain was in favor of the reading skills treatment group.

Comments

Since this study is not in harmony with the studies by Macione and others, which showed that the automatic level is more deficient than the representational level in children with reading disabilities, an explanation is in order. It is possible that the subjects, being 3rd and 4th graders, scored at the ceiling of the norms of the ITPA, thus depressing the scores and eliminating any possible differences.

Bartin Norma G. The intellectual and psycholinguistic characteristics of three groups of differentiated third grade readers. Unpublished Ed.D. dissertation, State University of New York at Buffalo, 1971.

Purpose

The study attempted to determine the extent to which specific intellectual processes and selected elements of psycholinguistic behavior would differentiate among normal third grade pupils demonstrating three distinctly different progress patterns in reading.

Subjects

Subjects were seventy-three third grade suburban pupils exhibiting three distinct levels of reading performance, Average Progress Readers, Mildly Disabled Readers, and Severely Disabled Readers.

Procedure

The categories of readers were determined by their performance on silent and oral standardized reading tests and on recent reading progress. The ITPA and WISC were administered as measures of psycholinguistic and intellectual abilities. Data were examined through analyses of variance and covariance and by "t" tests using the .05 level of confidence.

Results

1. There was found a significant difference between Average Progress Readers and Severely Disabled Readers on WISC full scale and verbal scale scores, on WISC Arithmetic and Digit Span subtests, and on ITPA Auditory Closure and Sound Blending subtests. On the ITPA Visual Closure subtest, the poor readers were significantly superior to the Average Progress Reader.

2. There was found a significant difference between Average Progress Readers and Mildly Disabled Readers on WISC Information and Block Design subtests and on ITPA Auditory Closure and Sound Blending subtests.

3. The Mildly Disabled and the Severely Disabled Readers differed significantly only on the ITPA Auditory Closure subtest.

4. The WISC full scale IQ and the ITPA total score correlated at .61, signicant at the .01 level.

Comments

Unexplained are the unlike results as to which WISC subtests differentiated Average Readers from Mildly Disabled and from Severely Disabled Readers. Such a discrepancy was not found with the ITPA; the same two subtests differentiated both groups of disabled readers from the average readers.

The results of this study seem to be at some variance with the studies of Kass, Macione, and others which indicated that Visual Sequential Memory differentiated good from poor readers.

Guthrie, J. T. and Goldberg, H. K. Visual sequential memory in reading disability. Journal of Learning Disabilities, 5 (January 1972): 41-46.

Purpose

The purpose of this investigation was to relate visual sequential memory to reading in normal and disabled readers.

Subjects

The subjects included 81 normal readers (mean CA of 8-5, mean WISC IQ of 98, and mean Gray Oral Reading Test score of 2.5) and 43 disabled readers (mean CA of 10-3, mean WISC of 99, and mean Gray Oral Reading Test score of 2.2). The disabled readers were two or more years behind their CA in reading achievement. All S's were drawn from the Baltimore Public Schools, the laboratory school of Towson State College, and a summer remedial reading program conducted at the Kennedy Institute of Baltimore.

Procedure

All S's were given the Benton Visual Retention Test (BVR), the Visual Sequential Memory subtest of the revised ITPA (ITPAM), the Gray Oral Reading Test (GO). The experimental group was also given the Metropolitan Reading Comprehension subtest (MRC); the control group was given the Knox Cube Test (KCT), the Visual Closure subtest of the revised ITPA (ITPAVC), and the Wide Range Achievement Test (WRAT). Data were analyzed by correlations and partial correlations to partial out the variable of CA.

Results

1. For the normal readers, the correlations among ITPAM, BVR, KCT, and GO were all significant at the .01 level; students who performed well on the Gray Oral Reading Test also performed well on the three measures of visual memory.

2. For disabled readers, none of the correlations among ITPAM, BVR, GO, and the MRC were significant at the .01 level.

3. The Benton Test correlated higher with reading than did other tests for disabled readers.

4. Intercorrelations among measures of visual memory and perception for normal readers are all significant at the .01 level as follows:

ITPAM and BVR	.38
ITPAM and KCT	.38
ITPAM and ITPAVC	.42
BVR and KCT	.34
BVR and ITPAVC	.46
KCT and ITPAVC	.49

Comments

The correlation of .38 between the Knox Cube Test and the ITPA Visual Sequential Memory is quite a bit higher than that obtained by Paletz and Hirshoren for the same age children; Paletz and Hirshoren obtained a correlation of .08 for 4th graders and .17 for 2nd graders. Subjects of this study were 8-5 or 3rd graders.

Low or zero order correlations of reading with the ITPA Visual Sequential Memory Test for disabled readers is at variance with other studies. This may be due to the use of the ITPA for disabled readers whose mean CA was 10.3, above the age norms for which the test was standardized. On Visual Sequential Memory the scores tend to show low variance within this age group, thus producing a restricted range.

Merlin, Shirley B. The psycholinguistic and reading abilities of educable mentally retarded readers. Unpublished Ed. D. dissertation, West Virginia University, 1971.

Purpose

The study attempted to determine why some public school educable mentally retarded children learn to read while others do not, by comparing the psycholinguistic and reading abilities of good and poor readers.

Subjects

Twenty-five good and poor readers were selected from intermediate and junior high special education classes of a southwestern Pennsylvania School District. Poor readers scored below 2.5 grade level and good readers scored above 3.0 grade level and near their expectancy level. Good readers ranged in CA from 10.6 to 15.0, in MA from 7.5 to 10.9, and in IQ from 60 to 80. Poor readers ranged in CA from 10.6 to 15.6, in MA from 7.2 to 11.9, and in IQ from 57 to 80.

Procedure

Subjects were administered the Spache Diagnostic Reading Scales and the revised ITPA. Statistical analysis of results included covariance and correlation.

Results

1. Good readers were significantly superior to poor readers in the representational and automatic levels, on auditory-vocal and visual-motor channels, and on composite PLA. They were also superior on the subtests of Auditory Reception, Grammatic Closure, Auditory Association, Visual Sequential Memory, Visual Closure, Auditory Sequential Memory and Manual Expression.

2. Spache Potential Reading Level score and ITPA composite Psycholinguistic Age score obtained higher correlations with reading scores and were considered better measures for determining reading potential than MA, CA, and IQ.

Comments

The ITPA subtests Auditory Closure and Sound Blending did not differentiate good from poor readers in this study. The author stated that all the teachers reported teaching phonics, which probably accounts for this lack of difference between good and poor readers. Differences in results found among studies may be due to differences in methods of teaching.

Deese, Jeanette C. A study of the discrimination by the subtests of the revised Illinois Test of Psycholinguistic Abilities between successful and unsuccessful readers of normal intelligence. Unpublished Ed.D. dissertation, Memphis State University, 1971.

Purpose

This study investigated the extent to which subtests of the revised ITPA would distinguish between successful and unsuccessful readers.

Subjects

The sample consisted of children between 7 and 10 years of age with IQ's of 85 or above who had been referred to a reading clinic for diagnosis.

Procedure

Unsuccessful readers were those reading one-half to one year below reading expectancy (basing expectation on years in school and IQ) in their second year of school, reading one and one-half years below expectancy if in their third year, and reading two or more years below expectancy if in their fourth year of school. Statistical comparisons using ITPA subtest scaled scores, composite PLA's, and PLQ's included analysis of variance and Discriminant Analysis of Two Groups.

Results

1. Significant differences between successful and unsuccessful readers were found on four of the six automatic level subtests (Grammatic Closure, Auditory Sequential Memory, Visual Sequential Memory, and Sound Blending) and on composite psycholinguistic age and psycholinguistic quotient.

2. No significant differences were found for the representational level subtests or for Visual Closure or Auditory Closure.

Comments

The results of this study are generally in harmony with those of Macione, Celebre, Ikeda, and Bartin, which also indicated that automatic level subtests differentiate good from poor readers.

Bannatyne, A. D. and Wichiarajote, Penny. Relationships between written spelling, motor functioning and sequencing skills. Journal of Learning Disabilities, 2 (January 1969): 4-16.

Purpose

This study investigated whether or not there were any significant differences between boys and girls and between good and poor spellers on the factors of meaningful motor functioning, balance, handedness, visuo-spatial ability, and various auditory and vocal skills.

Subjects

The sample consisted of 50 third graders (30 boys and 20 girls) predominately middle class, the majority of whom were coping with regular 3rd grade school work.

Procedure

The 50 subjects were given the following battery of tests: (a) the Bannatyne Visuo-Spatial Memory Test, which assesses memory for designs without involving motor activity; (2) the revised ITPA subtests of Auditory Closure, Sound Blending, Auditory Sequential Memory, and Visual Sequential Memory; (3) a standardized graded word written spelling test; (4) two balance tests, standing on one foot with eyes open and standing on both feet with eyes closed; (5) simultaneous writing which requires the writing of the numerals 1 through 12 down the page as quickly as possible using both hands simultaneously; (6) two tests of laterality of handedness; (7) the Graham-Kendall Memory-for-Designs test; (8) a letter span test, similar to digit span only using consonants; and (9) the PERC Auditory Discrimination test.

Results

1. There were significant differences (.01 level) between good and poor spellers on the ITPA Sound Blending and the unlearned handedness test of ambidexterity. Differences at the .05 level were obtained on the ITPA Auditory Closure, BVSMT simplified design choices, the Graham-Kendall, balance on one foot, and total balance score.

2. Significant differences (.05 level) between girls and boys existed on BVSMT rotated design choices, BVSMT complicated design choices, and balancing on both feet.

3. The written spelling test correlated as follows with ITPA subtests:

Sound Blending	.40 (significant at .01 level)
Auditory Closure	.11
Auditory Sequencing	.21
Visual Sequencing	.06

Comments

This is one of the few studies available relating spelling and psychological processes. Reference should also be made to the Zbinden study abstracted herein. Further studies are needed before conclusions can be formulated.

Zbinden, W. R. Psycholinguistic and perceptual correlates of spelling in educable mentally handicapped children. Unpublished Ed.D. dissertation, University of Illinois, 1970.

Purpose

The purpose of this study was to determine which psycholinguistic and/or perceptual variables included in this study correlated and accounted for the observed variance in the spelling achievement of educable mentally handicapped children.

Subjects

Subjects were 74 children (46 males and 28 females, 59 whites and 15 blacks) within the CA range of 8-5 to 12-8 and within the IQ range of 60 to 83 who were able to recognize the letters of the alphabet and to write them with 2 or less errors. Each subject was within the normal range of vision and hearing.

Procedure

Spelling achievement was measured by a recall spelling test of nonsense words, a recognition test of nonsense words, two forms of a standardized spelling achievement test, and a combined (total sum) spelling score. Each subject was given the revised ITPA, the Frostig Developmental Test of Visual Perception (revised edition), the Wepman Auditory Discrimination Test, the Bannatyne Visuo-Spatial Memory Test, and an individual IQ test. Pearson product-moment correlations and stepwise multiple correlation were used to analyze the data.

Results

1. Grammatic Closure correlated highest with the different spelling tests.

2. Spelling was more closely associated with the automatic sequential or nonmeaningful level than the representational or meaningful level tasks of the ITPA.

3. Auditory-vocal channel at the automatic-sequential level contributed most of the variance in predicting spelling of nonsense words and combined spelling score.

Comments

This is one of the few studies available relating spelling and psychological processes. Reference should also be made to the Bannatyne and Wichiarajote study abstracted herein. Additional research is needed prior to formulating conclusions.

Moffitt, P., Nurcombe, B., Passmore, M., McNeilly, A. Intervention in cultural deprivation: the comparative success of preschool techniques for rural Aborigines and Europeans. *Australian Psychologist*, 5 (March 1971): 51-61.

Purpose

This study was an evaluation of a pre-school intervention program for Australian Aboriginal children.

Subjects

Forty-four children (22 Aboriginal and 22 European) from a rural setting of Australia (Bourke, New South Wales) constituted the sample. The mean age at the time of testing was 52 months with a range of 42 to 56 months.

Procedure

Subjects were divided into four groups roughly matched for ethnic descent and verbal quotient (PPVT score). Two groups were exposed to a "traditional" pre-school program involving free play, creative expression, and unstructured verbal stimulation in a sensorimotor context. The remaining two groups received direct language instruction based on the Bereiter-Engelmann program. Each group attended the pre-school for 2 hours per day. Two teachers were used, each one teaching 2 classes per day, one traditional and one structured. The classes were switched from morning to afternoon three times during the year to allow for morning vs. afternoon attention span.

Pre- and post-tests administered within an 8 month interval included the revised ITPA, Form B of the PPVT, and the Vocabulary and Geometric subtests of the WPPSI. Data were submitted to "t" tests.

Results

1. Both structured and traditional groups made significant gains on the ITPA as measured by the mean scaled score of each group.

2. At the beginning of the program there was no significant difference between the group mean scaled scores of the structured and of the traditional groups; following the pre-school program there was a significant difference (.05 level) in favor of the structured group. The structured group made significantly more progress on Visual Reception, Auditory Association, Verbal Expression, Manual Expression, Grammatic Closure, and Visual Closure subtests.

3. IQ as measured by PPVT did not increase significantly for the traditional group, but an increase of 25 IQ points was significant at the .005 level for the structured group.

4. The Vocabulary subtest of the WPPSI showed significant gain for the structured group (.005 level).

Comments

The structured pre-school program appears to produce improved test scores in its subjects.

Saundargas, R. A., Madsen, C. H., Jr., and Thompson, Faith. Prescriptive teaching in language arts remediation for black rural elementary school children. Journal of Learning Disabilities, 3 (July 1970): 364-70.

Purpose

The purpose of this study was to determine the effects of prescriptive teaching based on psycholinguistic diagnosis.

Subjects

Subjects were thirteen 8-year-old black, rural, culturally different children (8 experimental and 5 controls) from a Leon County, Florida, public school who had been identified by their teachers as retarded in reading and language skills.

Procedure

All subjects were given pre-and post-testing of the Sheldon Reading Inventories and the revised ITPA in February and May. The remediation was conducted during March, April, and May. The eight experimental subjects were involved in a language arts program emphasizing (1) psycholinguistic remediation of language disabilities based on individual ITPA profiles, (2) linguistic patterning, and (3) sound blending. The control group was involved in the regular program--an individually prescribed program using programmed series and basic skill texts. The experimental subjects were tutored 15 minutes a day, 3 days a week, by Florida State undergraduates in homogeneous groups of 2 to 3 children. A reinforcement program was in effect in the classroom for both groups. Scores were analyzed by the Mann-Whitney U Test.

Results

1. Post-test ITPA results showed the experimental group was significantly higher than the control group ($p < .001$) on total Psycholinguistic Age.

2. Significant differences ($p < .05$) in favor of the experimental subjects were obtained on Auditory Association, Visual Closure, Visual Sequential Memory, and Sound Blending subtests.

3. In reading the experimental group gained 9 months, and the control group, 6 months; both gains were significant at the .05 level.

Comments

Significant improvement in reading by the experimental group cannot be attributed to any one variable because their treatment consisted of emphasis in three areas--psycholinguistic skills, linguistic patterning, and sound blending. The small N of 8 experimental and 5 control subjects renders any results tentative.

Lavin, Claire M. The effect of a structured sensory-motor training program on selected cognitive and psycholinguistic abilities of pre-school disadvantaged children. Unpublished doctoral dissertation, Fordham University, 1971.

Purpose

This investigation sought to determine the effect of a Delacato type sensory-motor training program on the psycholinguistic and intellectual abilities of pre-school disadvantaged children.

Subjects

The subjects were 54 pre-school children living in Harlem in New York City, half of whom were randomly assigned to a control group, and one-half to an experimental group.

Procedure

The revised ITPA and the PPVT were administered twice to each subject within a six-month test-retest interval. Initial analysis of differences in mean age, IQ score, and total psycholinguistic ability score revealed no significant differences between the control and the experimental group. The experimental group attended for six months an 8 hour day nursery school program of sensory motor training according to the rationale of Delacato. The control group children remained at home with no special treatment.

Results

1. Experimental group subjects scored significantly higher than control subjects in general psycholinguistic ability and on the four ITPA subtests of Visual Reception, Visual Sequential Memory, Auditory Association, and Visual Association.

2. No significant differences were found between groups on mean intelligence score or on the other 8 tests of the ITPA.

Comments

The conclusion of the author that no difference was found in intelligence scores (based on PPVT) might be contradicted by the significant difference found on the ITPA total score. Furthermore, the subtests of Auditory Association and Visual Association, in which differences were found, correlate highest with Binet IQ's. This kind of research does not determine the efficacy of a method since the Hawthorne effect is not controlled.

Garrison, M., Jr. and Hammill, D. D. Who are the retarded? *Exceptional Children*, 38 (September 1971): 13-20.

This study on using multiple criteria for selection of children for placement in classes for the mentally retarded included reliability coefficients for two ITPA subtests (Auditory Reception and Verbal Expression) and intercorrelations among these subtests and other tests.

Rasmussen, J. The ITPA: an examination of the background and development. Unpublished manuscript, Copenhagen, Denmark, 1970.

This pilot study was devised to evaluate a Danish version of the revised ITPA and to compare both rural and urban Danish children to U. S. standardization norms.

Sharp, Elizabeth Y. The relationship of visual closure to speechreading among deaf children. *Exceptional Children*, 38 (May 1972): 729-34.

This study investigated whether good and poor young deaf speechreaders differed in ability in visual closure, movement closure, and short term visual memory. Significant differences in test performance were found for the following tests: Visual Sequential Memory, Visual Closure, Porteus Mazes, Hidden Figures, Rhythm Patterns.

Shriner, T. H. and Daniloff, R. G. Reassembly of segmented CVC syllables by children. *Journal of Speech and Hearing Research*, 13 (September 1970): 537-47.

This study investigated time intervals between sounds in the perception-resynthesis performance of children. The authors believe that the revised ITPA Sound Blending subtest uses too large an interval between sounds.

Works, Marian N. Some variables involved in the reading process. Unpublished doctoral dissertation, University of Oklahoma, 1970.

This investigation of the relationships between rhyming (as measured by the Works Bratner Ability to Rhyme Test) and reading and between rhyming and performance on common predictors of academic success found that rhyming was not statistically related to reading as measured by the WRAT. There was found a significant relationship between rhyming performance and individual subtests and total scores of the Frostig, WPPSI, ITPA, and Metropolitan Readiness Test.

APPENDIX J

BRAIN-BEHAVIOR RELATIONSHIPS AND LEARNING DISABILITIES

by

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It is the intent of this paper to present reasonable arguments for paying increased attention to brain-behavior relationships in the development of concepts and practices in special education, especially as these concepts and practices relate to learning disabilities. Before such a specific position can be viewed with perspective, however, it is necessary first to establish a context--to articulate a background of considerations that will illuminate major problems in special education. The particular problems to which a consideration of brain-behavior relationships is relevant can then be identified.

In a most general sense, education both explores and depends upon the modifiability of human behavior. Recognition of the force and variability of this quality is reflected in providing different educational arrangements for different kinds of people. There are different kinds of programs for the talented and the untalented, young children and young adults, the blind and the sighted. That the modifiability of human behavior is frequently misjudged is attested to by our failures--the human end products of educational systems that fail somehow to meet the minimal behavioral standards that society demands and of which we judge them to be capable.

Basic questions concerning the modifiability of human behavior are of two kinds--how should behavior be modified and how can behavior be modified. Answers to the first question determine the content of education, and answers to the second comprise all of educational technology. The questions (and their answers) are clearly interrelated, and both classes of questions demand consideration of a mixture of rational or philosophic and scientific factors.

Special education demonstrates many of the complexities in the modifiability of human behavior alluded to above. The observational base that forms the basic rationale of special education is that the behavior of some children, in the context of the regular classroom environment, cannot be modified in ways that are judged to be at least minimally acceptable. In an individual instance the problem may be one of the wrong sort of behavior (e.g., the hyperactive or the emotionally disturbed child) or it may be an absence of appropriate behavior (e.g., failure to learn). It is clearly insufficient, however, merely to note that a child cannot be accommodated in a regular classroom environment. This basic observation begins a chain of events that may include both redefining educational goals and redesigning the conditions, techniques, and delivery instruction.

The selection, for the handicapped learner, of appropriate educational goals and the selection and design of procedures for attaining these goals clearly comprise all of the problems of special education. At the present time, there are no established principles either for the selection of goals or for the selection of strategies to attain goals which have general applicability. What kinds of educational technology work with what kinds of handicapped children simply is not known save for certain very narrowly circumscribed situations. This is not to say that individual youngsters cannot be helped or that nothing is known about mental retardation, emotional disturbance, teacher training, curriculum materials, or administrative arrangements. It is important to recognize, however, that principles relating handicapping conditions to educational programs to behavioral outcomes have not been established.

The pursuit of knowledge which will lead to the establishment of generally applicable principles must recognize sources from which help is most likely to be derived. Some problems must be at least partly approached on a rational basis, whereas others are amenable to empirical investigation. The following sections of the paper focus on selected empirical problems, and it is important to recognize both that investigative work can have merit only within a specified framework of values and that values themselves are not inherently derived from experimentation. For example, no amount of investigative work can specify the relative merits of "good" interpersonal relationships versus technical competence as outcomes of educational programs. Similarly, particular kinds of administrative arrangements may facilitate acquisition of educational skills. However, if these same administrative arrangements result in racially imbalanced classes, then whether or not such administrative arrangements should be continued cannot be decided altogether on the basis of empirical work. It is entirely appropriate to apply value judgments to educational goals and also to instructional arrangements, but it is necessary to recognize that one is then talking about "goodness" and "badness" and not about feasibility or effectiveness. No amount of scientific investigation can subvert the desirability of educational goals or administrative arrangements judged to be inherently worthwhile or justify educational practices judged to be morally corrupt. A full discussion of the role of value judgments in the selection of educational goals and technologies is clearly outside the scope and intention of this paper, but a final point should be made. There cannot, realistically, be a complete divorce between educational philosophy or values and principles established through scientific investigation. If investigative work suggests that certain educational outcomes are mutually exclusive for certain kinds of children, then to insist on attaining such outcomes is clear lunacy. Another way of making this point is to recognize that while modifiability is a characteristic of human behavior, infinite plasticity is not. Investigative work can help to reveal the range of educational outcomes possible, and our educational philosophies and values must reflect whatever restrictions exist.

The present and potential relevance of theoretical-experimental inquiry both to problems in special education generally and to the field of learning disabilities in particular cannot be stated without first specifying the exact problems being considered.

A convenient way of categorizing problems in special education differentiates between problems involved in the educational placement and management of the individual child and problems in the design of educational systems. The design of educational systems necessarily asks questions regarding administrative arrangements, manpower supply, cost effectiveness, communication networks, etc. These kinds of questions will not be considered in any specific or detailed way in this paper. Problems in educating the individual handicapped child include problems relating to the identification of handicapped children, problems in the selection of goals and teaching strategies, problems in mobilizing support systems apart from the classroom situation, and problems in evaluating the efficacy of special programs. Each of these groups of problems is discussed in the following section.

Problems in Identifying the Handicapped Child

The majority of conditions that result in severe educational difficulties in children are not especially difficult to identify. Mental retardation, gross emotional disturbance, defects of the musculo-skeletal system, and defects in vision and hearing are all conditions that are relatively easy to recognize in the school age child. While the educational usefulness of such labels may require close examination, nevertheless these conditions from the framework for a relatively reliable classification scheme. Unfortunately, the same easy reliability in identification does not apply to the condition of learning disability. The difficulties in conceptualizing and applying learning disability as a condition resulting in serious educational problems can be understood by noting its history and the basic intentions of the learning disability movement. The category of learning disability has arisen from a mixture of political and empirical considerations. Significant political factors include general expansionist tendencies in special education, increased public sympathy and support for children who fare poorly in school, rising concern with the possible adverse consequences of labeling children as mentally retarded or emotionally disturbed, and the increase in popularity of viewing occult neurological difficulties as causal factors in educational problems. An empirical or observational basis for the concept of learning disability is, however, well established. Dyslexia, strephosymbolia, perceptual handicap, and minimal brain damage are all terms that have been used to identify children with marked educational problems who do not seem to fit easily into other more widely used categories. Learning disability has become a convenient summary term replacing these other labels. In addition to the historically documented empirical base, it is probably true that children who seem not to thrive in their neighborhood schools are increasing in numbers, primarily as a result of the push toward educational excellence paralleling the resurgence of interest in science and technology.

Part of the difficulty in making operational and applying the concept of learning disability is traceable, then, to its non-empirical roots. Difficulties remain, however, even when political meanings are ignored and attention is focused on the valid, observational base of the concept. There is first the task of excluding a variety of handicapping conditions. A second task is that of gathering evidence relevant to the possible presence of "defects in information processing systems." Related to this is the task of constructing some base for establishing "reasonable expectations" in the educational potential of the child. Finally, a framework must be erected that enables one to judge the significance of a deviation between potential and performance. Among these many barriers the most difficult ones are the detection of information processing deficits and the establishment of educational potential. These problems will be discussed in later sections.

Problems in the Selection of Educational Goals and Teaching Strategies

It is obvious that there is and can be no universally appropriate educational goals for pupils assigned to special education programs. The development of self-help skills might be an appropriate long-range goal for a severely retarded child or for a child with severe orthopedic handicaps, whereas for less severely disabled children we normally have much higher aspirations. The prevention of future emotional and social problems is frequently the goal of many special education programs. The selection of educational goals inevitably reflects one's estimate of what a child is likely to be capable of achieving given a specified period of exposure to particular instructional arrangements. Stating this point in another way, teachers attempt to modify the behavior of students according to their own (the teachers) expectations. While we cannot yet specify in exact terms just what kinds of students can learn what kinds of things under what kinds of conditions, it is clearly important to recognize this problem as critical to the educational process and to secure what help may be available from various sources.

For the learning disabled child, the selection of goals appears to be a particularly complex problem. At issue is whether teachers should stress acquisition of educational and social skills or whether they should instead direct their efforts at correcting the underlying disorder. Many teaching procedures focus, for example, on correcting perceptual deficiencies or on improving motoric clumsiness rather than on the attainment of traditional educational and social skills. The assumption is that if the learning disorder can be directly treated, the child's handicap will be cured and normal development will follow. While this is an optimistic point of view, it is clearly at variance with assumptions normally made about growth and development. This is a problem of critical importance that will be discussed later.

The selection of appropriate teaching strategies is less arbitrary than the selection of goals because, if for no other reason, strategies can be modified as frequently as necessary, given knowledge of obtained results. Teaching strategies attempt to meld instructional content to learning styles, and a major problem lies in reducing the amount of trial and error behavior necessary to accomplish this.

Mobilization of Support Systems

It is clear that the effectiveness of an educational program is at least partially determined by how much support and understanding of the program exists in the non-school environment, especially the child's home. Excluding severely disorganized home environments and home environments in which there is obviously no interest in school activities, perhaps the most common source of trouble is home environments in which parental expectations far exceed educational goals and the child's capabilities. This is particularly true for children with learning disabilities where the handicap seems frequently to have the characteristics of an invisible force that operates only in the classroom setting. It is far easier to think of such children as lazy or rebellious or as victimized by poor teaching than it is to think of them as selectively impaired. If the nature of the learning handicap can be documented to parental satisfaction and if the expectations of the parents can be restructured, the child is less likely to be caught in the pressure cooker of high expectations and low performance. Unfortunately, the child's teachers are often as mystified by his behavior as are his parents, and shared perplexity as unlikely to prove a sound basis for building helpful support systems. Thus, a rational basis for building both parental and teachers' expectations assumes critical importance.

Problems in the Evaluation of Special Programs

The evaluation of special education programs frequently is limited to a head count of how many children with what kinds of handicapping conditions have been enrolled. Such a procedure yields scant satisfaction for teachers, who want to know if their efforts have merit, or for parents who need to know if their child is receiving the best help possible. Occasionally, for a particular child, there is such a radical change in behavior that the success or failure of the educational therapy is perceived immediately. More often, however, behavioral change is slow and uneven and sometimes bears little apparent relationship to treatment. In such instances evaluation can perhaps be accomplished only in terms of a conceptual framework from which expected rates of development in different areas can be inferred. This is especially true for the learning disabled child in whom such traditional predictors of development as mental age and IQ are thought to be untrustworthy.

To summarize the immediately preceding materials, there are significant problems in special education, and particularly in the field of learning disabilities, relating to identification procedures, the selection of educational goals and teaching strategies, the mobilization of support systems, and the evaluation of special programs. These problems derive in some degree from the mixed political-empirical basis for the concept of learning disbilities, and to a much larger degree from our general ignorance regarding what are reasonable expectations for the intellectual and educational development of the learning disabled child. The concept of "reasonable expectations" and from what sources expectations are and can be generated are viewed as critical problems for the education of the learning disabled child. It is to these ideas that the material which follows is addressed.

The empirical basis for what is reasonable to expect from children in school lies in the almost countless attempts, during this century, to measure and to elucidate the nature of intelligence. Moderate success can be claimed for the effort to predict school success under conditions of routine classroom instruction from intelligence test scores. This relationship is clearly useful in helping to identify certain groups of handicapped children (e.g., the mentally retarded), and it may be of value also in making preliminary judgments regarding the probable attainability of certain educational goals. For many of the problems in educating handicapped children, however, intelligence test performances have little relevance. Teachers cannot select teaching strategies on the basis of IQ scores, specific kinds of difficulties cannot be predicted from IQ scores, and the teacher of learning disabled children is hardly the wiser for knowing that her youngsters "should" have been successful in the regular classroom environment. Learning disabled children, by any generally accepted definition, are children whose intelligence test performances far exceed in adequacy their performances in school tasks. Thus, while intelligence test scores can be useful in helping to identify learning disabled children, our understanding of these children is not thereby increased.

It is necessary, at this point, to distinguish between intelligence and intelligence test performances. Unless one's thinking is limited to operational definitions, it is an offense against common sense to insist that children who are obviously impaired in learning ability have normal intelligence. Such children clearly are selectively impaired in their basic adaptive abilities, and it is only because intelligence tests include a relatively restricted sample of behavior that they fail to reflect such impairment. The development of frameworks which might permit a more adequate conceptualization of intelligence will surely aid our understanding of the learning disabled child. The intelligence testing movement does not provide such a framework since this movement has remained largely uninfluenced by theoretical considerations other than those deriving from work in statistics and measurement. Thus, concern with the structural properties of intelligence tests has, until recently, overshadowed concern with factors influencing the development of intelligence.

Frameworks within which the concept of intelligence is considered have traditionally focused on the normal child, emphasizing the interplay between genetic and environmental forces in determining abilities [e.g., Burt and Howard (1957), Burt (1958), and Jensen (1968)]. Educators have responded differentially to investigative efforts, seizing upon those findings which have illuminated the importance of social-cultural determinants of intelligence and ignoring work of equal scientific merit emphasizing the primacy of genetic factors. Thus, differential responsiveness has been reinforced by the broader cultural zeitgeist emphasizing the importance of correcting such social ills as poverty, joblessness, racial discrimination, etc. Throughout this social-educational fabric, there seems to be the unspoken fear that biology may prove to be a force which is inherently inimical to social progress, human welfare, and quality education. The absurdity of this fear is equalled by the magnitude of its deleterious effects--the failure to design social and educational systems whose effectiveness depends on adequate recognition of biological factors.

The investigative work referred to above focuses on biological and cultural factors in normal development. More directly relevant to problems in special education is work focusing on the development of deviations in intelligence and learning ability because it is the problems arising from such deviations that form the challenges of special education. There are three principal bases of inquiry--genetics, public health and epidemiology, and the neurological sciences.

A comprehensive survey of work focusing on the genetic foundations of intelligence is provided by Jensen (1969). The critical points elucidated in this article are as follows:

1. Genetic factors are of much greater importance than environmental ones in influencing intelligence.

2. Knowledge of the role of genetic influences is clearly inadequate as a basis for counseling or educational planning on an individual basis.

3. Certain kinds of intellectual abilities are more influenced by genetic factors than others. Specifically, "abstract reasoning" and capacity for "insightful" learning are more clearly tied to genetic factors than "associative" learning.

4. Although most educational programs are designed to offer maximum opportunity for abstract reasoning and insight, it should be possible to design programs to achieve critical behavioral competencies which at the same time will diminish the disadvantages in which genetic factors normally result.

5. It is unreasonable to design (or to evaluate) educational programs using intelligence as a principal criterion variable. It is suggested that acquisition of specific skills is a more useful criterion variable.

The context for the above points is the indifferent success of the many compensatory educational programs designed to counteract the alleged influence of culturally impoverished environments on the educational aptitudes of young children. It is important to remember that the heritability of intelligence is not an argument against early education, but rather that the design and intent of such programs should reflect the characteristics of the children for whom the programs are intended.

Investigative work in public health and epidemiology stresses that educational aptitude is one of many expressions of the total health status of the individual. Families in whom the children are known to be at risk with respect to school success regularly show many other indices of poor health (i.e., high infant mortality, premature births, inadequate nutrition, low tolerance for infectious disease, etc.). Birch and Gussow (1970) have summarized the interrelationships among health variables in poverty groups and present well reasoned arguments for the kinds of intervention strategies that are needed.

The epidemiology of health and learning disorders is presented in a very different way by Rutter et al (1970) using as their data base a complete survey of children of selected ages living on the Isle of Wight. All children of ages nine through eleven years were examined with a battery of psychological and educational tests and were also given thorough health examinations. Data gathered from these procedures permitted the investigators to study the incidence and distribution of intellectual retardation, educational retardation, behavior disorders, and physical handicaps. One child in six was found to have one or more handicapping conditions. Intellectual retardation and educational retardation were significantly related to social class, but behavior disorders and physical handicaps were not. Ninety percent of the intellectually retarded children had other handicapping conditions as did forty-three percent of the educationally retarded children, thirty-one percent of the children with behavior disorders, and twenty-nine percent of the children with physical handicaps. Definite neurological abnormalities were routinely present in the children with severe intellectual retardation (IQ scores below 50) and frequently present in children with mild retardation (IQ scores between 50 and 70). Definite neurological abnormalities were not found in children with educational retardation, but these children demonstrated delays in language acquisition and abnormalities in motor functions significantly more frequently than did the control group. As a general conclusion, the data from this comprehensive study indicate that intellectual and educational problems are frequently associated with other health-impairing conditions and especially with conditions suggesting involvement of central nervous system functions.

The work in genetics and particularly the investigations in public health and epidemiology combine to form a rationale for viewing intelligence and learning ability in a biological context and as partial expressions of the total health status of the child. The implications of this viewpoint for intervention strategies are that such strategies should be comprehensive in scope, focusing on multiple factors known to be inimical to health. It is necessary, however, to be much more specific. The classroom teacher is faced with the responsibility for accomplishing highly specific tasks with individual children. It is difficult for the teacher to utilize, in any focused manner, knowledge of the social-biological context in which learning disabilities occur. Furthermore, there are many learning disabled children whose health status seems otherwise intact, whose families appear intact, and who appear not to have been victimized by oppressive environments. For such problems the biological frame of reference must be transformed into specific ways of understanding, managing, and helping the disabled child. The necessity for such a transformation is not unique to problems in special education any more than the growth and development of handicapped children is solely the responsibility of special education personnel. Such responsibility must clearly be shared between personnel in education and personnel in selected fields of medical practice. The neurological sciences are specifically relevant to problems in education. Children with learning disabilities are disordered in their brain-behavior relationships, and specific procedures for understanding brain-behavior disorders from the material for the following section.

The field of activity which can be broadly identified as brain-behavior relationships can be divided into three interrelated parts--empirical studies, investigative procedures, and clinical practice. A comprehensive survey even of a single part is not possible here, but it is necessary to attempt a precis in order to convey some sense of how each field of activity is or may be relevant to problems in special education.

Empirical Studies

Empirical research in brain-behavior relationships began during the first half of the nineteenth century. A convenient anchoring point is the work of Bell and Magendie resulting in the anatomical separation of motor and sensory nerves in the spinal column. This discovery was followed closely by Johannes Mueller's doctrine of specific nerve energies and somewhat later by Helmholtz's refinement of Mueller's statement into the doctrine of specific fiber energies. The important effects of these early investigations were to establish the primacy of the central nervous system, and especially the brain, as the vehicle for understanding the qualities of the experimental world and to pave the way for the search for specific brain centers. An early figure of enormous significance in this search was the French physiologist Pierre Flourens. Flourens, using the method of surgical extirpation, formulated his laws of "action proper" and "action commune", and in so doing anticipated modern thought. Lahsley's doctrines of equipotentiality and mass action are updated versions of Flourens' work. From Flourens it is possible to trace a clear line of inquiry which extends to the present. The important names are Munk, Ferrier, Fritsch, Hitzig, Franz, Lashley, Walter, and Magoun. The common theme that unites these investigative efforts is the quest for understanding the role of the normal brain in the regulation of normal behavior. It is important that the nature of this quest be understood clearly because the relevance of the work that it produced to an understanding of disorder and brain-behavior relationships is much less than is generally presumed. Diseases and lesions of the brain produce a total reorganization of brain functions and brain-behavior relationships, and these effects can neither be understood nor duplicated by studying normal brains or by removing normal tissue from normal brains. The guidelines for generalizing from normal to disease states have simply not been erected. This problem in understanding the limiting features of particular lines of inquiry was early recognized by Hughlings Jackson. Jackson (1958) succinctly argued that to study a brain lesion which alters a given realm of behavior is a far different thing from assigning a specific location in the brain to that particular class of behaviors. The clinician is always in the position of having to study the altered functioning of the remaining intact parts of the brain rather than the damaged area itself. The thinking of Jackson exemplifies a line of inquiry emphasizing the direct investigation of clinical problems is the most appropriate means for understanding those problems. The most notable example of this approach during the last century, excluding Jackson's efforts, is Broca's famous study of an aphasic patient whose timely death permitted Broca to discover a lesion in the patient's left posterior frontal lobe. In this century the tradition of Jackson and Broca is most easily seen in the work of Henry Head, Kurt Goldstein, and Ward Halstead. Head studies language disorders in adult patients and leads a distinguished tradition of clinical research in this area. Goldstein studied World War I brain-injured soldiers and concluded that the most important consequence of brain lesions was to create a qualitative disturbance in thinking which Goldstein described as impairment of the "abstract attitude." Halstead developed the battery of neuropsychological tests which bears his name and published his important monograph just after World War II (Halstead, 1947). The common theme which unites the clinical investigations of brain-behavior relationships is the search for regularities in the effects of brain lesions on the basic adaptive abilities which human beings possess. [Comprehensive reviews of this area of inquiry have been written by Teuber (1955), Reitan (1962), Birch (1964), and Yates (1966)]. This clinical search has at least prima facie relevance for the problems in special education which are presented by children with brain-behavior disorders. For this reason it is appropriate to present a capsule statement of major substantive findings and also to note certain critical limitations in our knowledge.

1. Brain lesions typically (but not invariably) result in both generalized and specific impairment of abilities. Another way of stating this is that certain abilities (notably, abstract thinking) appear to be diffusely represented in the cerebral cortex, whereas others (e.g., speech, specific motor and sensory skills) have quite specific representation.

2. The specific effects of brain lesions appear to be primarily related to the location of the lesion, but these effects may not appear if the lesion is incurred pre-natally or very early in life. For example, speech and language usually show specific adverse effects from lesions involving the left temporal lobe. Massive left cerebral hemisphere lesions incurred very early in life, however, usually result in generalized retardation rather than in specific speech and language problems.

3. Certain types of abilities appear to be more vulnerable than others to the influence of brain lesions. This may be related to how these abilities are represented in the cerebral cortex (see #1 above). Cattell (1963) has identified two broad groups of abilities which he has labeled as "fluid" and "crystallized" abilities. This classification seems to correspond to Reed's (1963) "immediate, adaptive abilities" versus "stored memory" continuum. Brain lesions appear especially to affect fluid intelligence or basic problem solving strategies as compared to stored memories or highly specific skills.

4. The effects of brain lesions change over time. Measurement taken shortly after a lesion has been incurred may reveal quite different effects from measurements taken months or years later. The changes may reflect continued development of the individual following the brain insult, a differential rate of recovery, or a combination of both factors. Changes in the effects of brain lesions are thus related to the type of lesion, the condition of other parts of the cerebral hemispheres, the age of the patient, and methods of investigation.

5. As an extension of the preceding point, brain lesions in children appear to have effects which may differ substantially from the effects of brain lesions in adults. This generalization is subject to so many limitations, however, that its usefulness must be seriously questioned. It has not yet been possible to do comparative research studies which adequately control such variables as lesion type and location, lesion duration, age of patient at time of injury, etc. For a discussion of the problem, see Reed and Fitzhugh (1966). However, the recent research of Boll and Reitan (1972) and the massive project of Myklebust and Boshes (1969) suggest that the relative importance of quantitative versus qualitative effects may be different for adults than for certain groups of children, especially those now designated as "minimally damaged."

The significance of the five major substantive findings discussed above is difficult to evaluate both from a scientific and a utilitarian point of view. The scientific quality of our knowledge of the effects of brain disorders in human beings is sharply limited by the absence of sampling procedures, by the variable availability of neurological criterion information, and by the relative absence of longitudinal research. The utility of the substantive findings discussed above is limited in the same way that most generalizations involving the behavioral sciences are limited. For a particular individual the statistical procedures used to arrive at the generalizations may conceal more information than they reveal. Such procedures overlook intra-individual variability, and this may be the essence of understanding the individual patient. Fortunately for utilitarian purposes, there is some basis for believing that we may know more than the broad generalizations suggest. The breadth and significance of present knowledge is revealed in investigative procedures and in clinical application. These areas form the material for the following two sections.

Methods of Investigating Brain-Behavior Relationships

Investigative procedures may be categorized into (a) methods for study and control of independent variables (the condition of the brain, etc.) and (b) methods for studying the behavioral consequences of brain lesions. For the control and study of dimensions of brain dysfunction, there is an armamentarium of neurological procedures ranging from obtaining anamnestic information to neuropathological techniques. Because of the general unfamiliarity of these procedures to personnel in special education, some general comments concerning their characteristics are in order.

Procedures in the neurological sciences used for assessing brain dysfunction vary in the "directness" of the information they yield. At one extreme are procedures involving direct visualization of brain tissue. For example, both the neuropathologist and the neurosurgeon directly examine brain tissue, and positive findings from these sources constitute the most trustworthy information that ever can be obtained. The procedures of neurosurgery and neuropathology are applicable, however, only to a small percentage of human beings with brain lesions, and hence this information is generally not available. In the absence of positive findings, one cannot necessarily infer that a brain lesion does not exist, a limitation shared by all of the investigative procedures. Contrast studies of the brain (angiography, pneumoencephalography) are most useful in determining the presence of mass lesions. Information from these procedures clearly involves making inferences about the brain, and the procedures cannot ethically be employed unless the patient's condition so dictates. Procedures involving even greater inferential processes include echoencephalography and electroencephalography. Since these procedures are risk-free, they can be routinely used with human subjects, but the information they yield is frequently suspect. Negative information from these procedures is of limited value. Occasionally, the information derived from the EEG, for example, will be of such a character as to make a definitive diagnosis possible, but this is frequently not the case. The same limitations apply to anamnestic or case history data. Occasionally, on the basis of the history alone, it can be definitively stated that the patient is brain-damaged. One can rarely say more than this, and it is more frequently true that definitive statements of any kind simply cannot be made.

Because of examiner differences, the physical neurological examination is more difficult to describe than the kinds of investigative procedures outlined above. In its classical form, the neurological examination focuses on asymmetries in function, concentrating particularly on the status of the cranial nerves and on disorders of station and gait. For the classical form high inter-examiner agreement can be demonstrated, and positive findings generally are valid indications of disorders of CNS functioning. As with other examining procedures, negative findings on the classical neurological examination cannot safely be interpreted as signifying an absence of CNS dysfunction. There are countless neurological disorders which do not produce asymmetries in function. This is especially true for disorders of development, and because of this there have been a number of attempts to supplement the classical neurological examination with a variety of mental and motor tasks designed to reveal developmental disorders, including disorders expressed specifically in mental development. Illustrative of these attempts is Ozer (1968) and the Phase Two monograph of the task force in minimal brain dysfunction in children (Public Health Service #2015, 1969). The above point may be stated in a somewhat different manner as follows: the validity of the classical neurological examination depends principally on differences in functions between the two sides of the body, thus using each subject as his own control. Developmental disorders, including alterations in mental growth and development, are frequently revealed more readily by age-normed tasks in which the child is compared to a standard reference group.

The inclusion of norm-referenced mental and motor tasks in a comprehensive neurological examination creates special problems. The relationships between such tasks and other investigative procedures in the neurological sciences must be carefully established. In the traditional view of the world of brain-behavior relationships, "brain things" have been conceptualized quite differently from "behavior things," this distinction being expressed in the traditional classification of independent and dependent variables. Erasing this distinction may result in conceptual confusion, but it also fosters an integration between medical science on the one hand and educational and behavioral sciences on the other.

The conceptual confusion can be clarified by research exploring the relationships between the traditional neurological investigative procedures and the "new look" which emphasizes the usefulness of measures of mental abilities. Fortunately, this "new look" is not new to the behavioral sciences, there being a distinguished tradition of research emphasizing psychological tests in assessing the consequences of brain dysfunction. A summary of this research follows.

The use of psychological tests in investigating the effects of brain damage on human abilities is an area of work that forms a bridge between the neurological sciences and the behavioral sciences and that has important implications for educational practice. Most of the systematic work has been done with adults, and good surveys of the literature are available [e.g., Myklebust and Boshes (1969), Deutch and Schumer (1970)]. It is not here the intent, however, to summarize the empirical studies, but rather to emphasize two kinds of methodological contributions which are judged to be of special importance.

The first of these methodological contributions relates to the appearance of test batteries designed to be specifically sensitive to the organic condition of the brain and which permit the employment of a variety of interpretative procedures. It is generally true that psychologists have been guilty of oversimplifying problems in brain-behavior relationships, using a single test approach which does justice neither to the complexity of the brain nor to the complexity of behavior. The behavioral manifestations of brain damage are fully as numerous and complex as conditions which adversely affect brain functions, and the use of a single test to explore the effects of brain damage denies this basic premise. For example, brain lesions may result in generalized impairment of abilities, they may result in highly selective impairment (e.g., impairment limited to language skills), lesions may differentially influence sensory-motor functions on the two sides of the body, they may generate pathognomonic signs, etc. Only by using a comprehensive battery of tests can one do even approximate justice to the problem. For full discussion and illustrations of this problem, see Reed (1971).

A second important methodological contribution is reflected in studies demonstrating the use of psychological test results with individual patients. The great bulk of research investigating brain-behavior relationships in human beings has focused on comparing groups of brain-damaged patients with control groups. Such studies have limited applicability to problem situations in which the individual subject or patient is the only meaningful unit. Crinella and Dreger (1972), Knights and Watson (1968), and Reitan (1964) have discussed this problem in detail and have proposed and demonstrated solutions for it. It is sufficient here to note that well-trained personnel using appropriate psychological tests can draw specific conclusions about individual patients. Because of the environments in which these investigators have worked, the kinds of conclusions drawn about individual patients have typically related to neurological variables. If the capability for understanding the single brain-damaged subject is to be applied to educational problems, then the locus of research must change from the hospital and clinic to the school.

The Contributions of Clinical Practice

The two immediately preceding sections have briefly summarized some of the major empirical findings and investigative procedures in brain-behavior relationships. One way of testing both the usefulness and the limitations of this knowledge and these procedures is to examine how they are applied in clinical practice. By clinical practice is here meant the diagnosis and management (not including educational problems) of the individual child who is known or suspected to have a disorder involving brain-behavior relationships. In clinical practice one not only applies tested principles but one also, at least hopefully, observes new ideas which eventually attain the stature of testable hypotheses. One also evaluates his successes and failures, although the limitations in doing so, the gross restrictions regarding cause-effect relationships, are immediately apparent. It is hoped that by examining clinical practices that some sense of the "state of the art" in brain-behavior relationships can be conveyed. It is this writer's belief, based on detailed experience, that personnel in special education have much to gain by being knowledgeable about the philosophy and practices of other disciplines who share responsibility for the management of the handicapped child. For purposes of discussion it is convenient to separate the duties, responsibilities, and problems faced by psychologists.

The physician is frequently the first line of defense for the parents of the handicapped child. The presenting complaint is often parents' suspicion that their youngster's development is not proceeding normally. With the child of school age, this suspicion may have been generated or reinforced by teachers' concerns. The physician's responsibilities include conducting or arranging for a complete evaluation, initiating treatment where this is appropriate, and planning a long-term management program that will permit him to monitor growth and development. For most children whose primary complaints combine school difficulties, slow or uneven development, and behavior problems, there is little the pediatrician or pediatric neurologist normally attempts by way of specific treatment. Patient management, however, presents a complex set of challenges that may keep the physician very actively involved. The goal is not one of ameliorating specific handicaps, but rather of doing whatever is possible to effect the best possible adjustment for the child and his family. In pursuit of this, the physician may use drugs in an attempt to control hyperactivity and mood disorders, he probably will attempt to modify parental expectations, he may suggest or discourage certain child-rearing practices, he will probably discuss issues of educational placement and management, and he will monitor and evaluate, on a continuing basis, the total growth and development of the child. This description of how a physician functions is not meant to imply that he operates in isolation from other professionals. He frequently depends on data gathered by psychologists, social workers, and other physicians, integrating data from these sources with his own observations and fashioning it all into a package he can make sense of. The specific contribution of the psychologist will be discussed later, but it is important first to understand the underlying philosophy that guides the physician. This philosophy argues that organically determined disorders of growth and development are not usually directly treatable. The total welfare of the child is, however, not determined by his disorder, but rather by the demands the child's environment makes upon him. The child's growth and development will proceed at its own pace, being governed by factors which are presently beyond our control. The environment, however, consists of controllable influences, and whatever modifications are necessary to fit the environment to the child must be attempted. Furthermore, as the child's growth and development change, the environment must change in corresponding ways, and hence the need for regular periodic evaluations.

For the psychologist who shares, with the physician, responsibility for patients with disorders in brain-behavior relationships, there are several regularly recurring, interrelated questions which must be answered. Often, these are questions which the physician has already explained, but he recognizes that the psychologist can supply more precise answers.

1. What is the child's general rate of intellectual development?

2. Does the child have significant deviations in his abilities which are not reflected in summary scores used to indicate level and rate of development?

3. If the child has significant ability deficits, do the psychological test results suggest the presence of organic brain dysfunction?

4. What is the predicted course of development for this child?

5. What are the practical consequences of the child's ability deficits?

6. What is the educational status of the child? Can he be expected to compete successfully with his peers, and if not, what kinds of changes in his school situation are reasonable to advise?

7. If this is a child who has been examined on earlier occasions, how has he changed and of what significance is this?

Supplying answers to the above questions constitutes much of the clinical practice of the psychologist who specializes in brain-behavior disorders. This exercise reveals both present capabilities and problems that still await solution. Because it is important to discuss both, a detailed analysis of these questions follows.

1. _What is the child's general rate of intellectual development_? In cases where a meaningful answer to this question is possible, the answer is in the form of mental age and IQ scores. There are many children, however, for whom such scores may be quite misleading because of pronounced intra-individual variability in quality of performances. In such instances it is important to state this impression very clearly. It is also important, for obvious reasons, to note any large discrepancy between the physician's impression of the child's rate of development and psychological test findings.

2. _Does the child have significant deviations in his abilities which are not reflected in summary scores used to indicate level and rate of development_? The answer to this question supplements the answer to question #1. It is particularly important to compare the intelligence test performances on other measures of cognitive functions and to compare verbal with performance abilities. These comparisons provide a context for the IQ scores and may suggest in what ways the IQ scores do not reflect a true picture of mental and motor development.

3. _If the child has significant ability deficits, do the psychological test results suggest the presence of organic brain dysfunction_? This is probably the most difficult question for most psychologists to answer satisfactorily, and there is no substitute for specialized training and extensive experience in working with neurologically impaired patients. It is not sufficient merely to note the presence or absence of brain dysfunction. If brain dysfunction is judged to be present, it is then necessary to indicate whether it appears to be old or recent, static or progressive, focal or diffuse, etc. It is also important

to note which areas of the brain appear to be maximally involved. Finally, it is important to try to interpret the brain dysfunction in the context of whatever history information may be available. The psychologist should note well that the information he conveys may significantly influence the behavior of the physician, the attitudes of the child's parents, and the attitudes of other significant adults (e.g., school personnel) who interact with the child.

4. What is the predicted course of development for this child? This question is not difficult to answer for children who demonstrate relatively even rates of growth across different ability areas. For such children, regardless of level of functioning, mental age and IQ scores are genuinely useful predictor variables. It is a very different matter, however, to make predictions for children who show markedly uneven rates of development. For such children, the necessary longitudinal research has not been done, and one is forced to rely on personal experience. It is this writer's experience that two or possibly three patterns of deviant development can be distinguished. One pattern is represented by the six or seven year old who has IQ scores in the average range, but who has obvious deficiencies in neuro-muscular integration and whose attention span may be shorter than normal. Such children frequently perform less well in first and second grade than would be predicted for them on the basis of their IQ scores, and this is probably because of activities in these grades which require motor dexterity. If such a child is re-evaluated one to two years later, he may still demonstrate clumsiness out of proportion to his age, but his motor skills are now sufficient to meet the demands of regular schoolwork. If by that time, however, the child has developed negative emotional attitudes toward school, he may be genuinely handicapped. Clearly, the challenge with such children is to try to keep them out of trouble until they have matured sufficiently to handle the demands of classroom work. Sometimes this can be accomplished by discussing the child's development with his parents and teachers. In other instances, it is helpful to retain the child for an extra year in grade one.

A second pattern of development is represented by the child whose intelligence test performances are unremarkable, but who demonstrates mild but consistent motor (and perhaps sensory) deficits involving the right side of the body. These deficits may be quite mild and unnoticeable on routine clinical examination. Such a child almost certainly, however, has cerebral dysfunction principally involving the left cerebral hemisphere, and this kind of involvement appears to interfere specifically with learning to read. The child may have IQ scores in the high-average to superior range, but reading skills are only average or the child may have average IQ scores and be failing in reading. The prognosis for such children appears poor in the sense that they rarely develop reading skills commensurate with their tested abilities. Many such children can, however, achieve in school at minimally satisfactory levels if they are given extra help with their reading on a continuing basis. It is critically important that the child's parents and his teachers be fully informed regarding the nature of his problems so that their expectations can be appropriately modified.

A possible third pattern of development is represented by the child whose primary difficulty is hyperactivity. The child may also demonstrate such other features as impaired attention, impulsiveness, emotional lability, etc. The clinical course of hyperactivity is known to be age-related, normally subsiding by age nine or ten. It is also true, however, that by the time the child is able to control his hyperactivity, he has developed severe secondary emotional and educational problems. Hyperactive children can be almost unbelievably difficult to manage, and every form of help that is available should be utilized. Drug therapy, parental counseling, small group placement in school may all be helpful in preventing secondary problems from developing, and certainly all such strategies should be attempted.

5. What are the practical consequences of the child's ability deficits? Answers to the above questions depend entirely on factors unique to each situation. It is important to note that many (probably most) neurologically impaired children function normally both in school and in extra-school situations. For many others the impairment attributable to neurologic involvement is expressed in generalized impairment of abilities, and IQ scores are trustworthy indicators of development. For each child, however, it is necessary to assess how much the parents already know, how much school personnel know, and the probable expectations of both. It is also necessary to know what kinds of changes in environmental factors are possible. Only then can one hope to achieve the best fit possible between the child and the various environments in which he must function.

6. What is the educational status of the child? Can he be expected to compete successfully with his peers, and if not, what kinds of changes in his school situation are reasonable to advise? A child's educational status has little, per se, to do with brain-behavior relationships. In other words, the answers to the question are secured through direct measurement of educational accomplishments, just as they would be for any child. Whether or not the child can compete successfully with his peers can be answered only if one has detailed knowledge of appropriate characteristics of the peer group. It is important to note, in this context, that a normal child of average ability who is achieving at grade level in school may be totally unable to compete successfully with other children in his class. This is frequently true in affluent suburban school systems where mean achievement scores are well above national averages. Such children are frequently labeled as "learning disabled" when in fact the disability might more appropriately be said to lie in the school rather than in the child. If the child cannot be expected to compete successfully with his peers, then one is expected to make appropriate educational recommendations. In this writer's experience, this is probably the most difficult area of all in which to function effectively. If psychological testing is done appropriately, it is generally possible to outline ability strengths, ability deficits, and, with lesser confidence, expected courses of development. One can specify what kinds of educational goals appear to be appropriate and goals that are almost certainly inappropriate. The critical problem, however, consists of selecting the teaching procedures and the curriculum materials that offer the best opportunity for optimal development of the child's educational potential. The kinds of psycho-educational research programs which might provide answers to these questions have not been undertaken, and therefore specific answers to these questions are not available. The capacity to do the research exists, but this is of little use until it is actualized. Meanwhile, teachers can be encouraged to experiment, to learn from their successes and failures, and to look for clouds with silver linings.

7. If this is a child who has been examined on earlier occasions, how has he changed and of what significance is this? This questions obviously presumes the existence of serial psychological examinations. It is almost impossible to over-estimate the advantages of this strategy. By comparing test results

taken at two different points in time, it is possible to estimate rates of development in critical areas and to modify recommendations and management plans accordingly. It is possible to identify children in whom growth and development do not appear to be proceeding as expected and to submit these children to intensive investigative procedures. Such children may have progressively disabling diseases of the central nervous system, they may have seizure disorders not previously identified, or they may be the victims of oppressive environments that have not permitted the expected amount of growth and development. Serial testing does, however, generate many difficult technical problems. Some of the most useful psychological tests are notoriously subject to practice effects, and others are suitable only for specific age groups. While no entirely satisfactory solutions to these problems presently exist, the problems are not so severe as to negate the advantages of serial testing.

The intent of the preceding material on clinical practices has been to describe how physicians and psychologists who specialize in brain-behavior disorders actually function--their philosophies of treatment and management, the problems they face, the questions they ask, and the procedures they employ in securing answers. Although the focus of the clinical practices discussed above has not been the child in the classroom, it is clear that the questions that have been discussed could have been asked by personnel in special education just as readily as by personnel in other disciplines. In an earlier section of this paper, four problems of particular significance to special education were discussed. The following material returns to these problems, re-examining each and the ways in which the knowledge, techniques, and practices in brain-behavior relationships are relevant.

Problems in Identifying the Handicapped Child

The specific problems in identifying the learning disabled child that were noted earlier include gathering evidence relating to the presence of "information processing deficits" and establishing "reasonable expectations" for the child's performance in the classroom. Work in brain-behavior relationships has general if not specific relevance to each of these problems. It is possible, using a variety of procedures, to identify among educationally handicapped children the ones who are neurologically impaired. The procedures for doing this focus on identifying ability deficits, but not specifically on defects in information processing. These same procedures contribute to an understanding of what can reasonably be expected from a child. The problem is that these expectations are not yet sufficiently detailed and refined to be maximally useful to the classroom teacher.

Problems in the Selection of Educational Goals and Teaching Strategies

Knowledge of the kinds of ability deficits a child has and knowledge of probable courses of development are clearly useful in specifying the probable attainability of educational goals. Precise specification is not, however, possible. Similarly, certain kinds of management strategies are often implied by a knowledge of brain-behavior relationships, but this is not the same as specifying teaching strategies designed to ameliorate the basic brain-behavior disorders which make the direct assumption that the course of mental growth and development can be modified by training procedures. This assumption is not made by personnel in disciplines other than the teaching profession, and there is nothing in the research literature which lends it credibility. Furthermore, the assumption may have negative consequences. It may divert time and attention from the pursuit of traditional educational goals, and it may also create unrealistic expectations in both teachers and parents. Even if such teaching procedures were to be discarded, however, the problem of which teaching procedures to select remains. It is clear that different teaching procedures make different cognitive demands, and thus some kind of marriage should be possible between a child's pattern of abilities and the ways in which he is taught. We do not yet know what kinds of specific demands teaching strategies make on abilities, and this is obviously an area where research is critically needed.

Mobilization of Support Systems

In the mobilization of support systems, a knowledge of brain-behavior relationships is specifically and often dramatically useful. The general nature of the problem presented by the learning disabled child is reasonably clear, and this information can be used effectively in structuring parents' and teachers' expectations. The environment of the child can be redesigned so that it will support rather than punish him, and many of the disabling secondary emotional and attitudinal problems can be prevented.

Problems in the Evaluation of Special Programs

This is again an area in which the work in brain-behavior relationships has general but not specific relevance. We now know something about courses of development in learning disabled children, we know something about the secondary handicapping problems that normally appear, and we know something about the probable attainability of broad educational goals. This kind of knowledge provides a common sense basis for evaluating special education programs. It is readily apparent, however, that refined evaluation requires much more precise knowledge than is now available. Furthermore, there is still the vast area of ignorance concerning the usefulness of specific teaching procedures, specific curriculum materials, and specific administrative arrangements. Until we accrue more knowledge in these areas, efforts to judge the value of special programs will be sharply limited.

It was stated originally that the intent of this paper was to present reasonable arguments for paying increased attention to brain-behavior relationships on the development of concepts and practices in special education. Brief summaries of what we know about empirical relationships, investigative procedures, and clinical practices have now been presented, and the possible relevance of this knowledge to problems in special education has been noted. It is now appropriate to discuss what must be done if we are to learn more about brain-behavior relationships and particularly about their specific relevance to educational problems. Two considerations are of obvious and primary importance. The locus of research must be moved to the classroom, and the research team must be expanded to include the classroom teacher. These are familiar arguments since they are used to explain the relative non-applicability of most research to problems in special education. The arguments are none the less valid, however, merely because they are familiar. Most of the difficulties that are apparent when one attempts to apply knowledge of brain-behavior relationships to problems in special education have arisen for one of two reasons--inadequate sampling procedures and failure to study actual educational tasks in any specific way. Most of what we know about brain-behavior disorders in human beings has learned from patients who have appeared in doctors' offices, clinics, and hospitals. We have had to make the very tenuous assumption that children with learning disabilities who have appeared in such places are not unlike other children with learning disabilities. The biases in our knowledge that exist because we have not been able to institute appropriate sampling procedures are not known and cannot be known until samples of learning disabled children, together with appropriate control groups, can be selected. The failure to use actual educational tasks in investigating the effects of brain-behavior disorders probably stems more from the personal backgrounds of the investigators than from anything else. Most researchers in this area are not trained in education and know next to nothing about teaching procedures and educational materials. The problems in utilizing public schools for research investigations are numerous and difficult. Teachers are not trained researchers, teaching methods and materials are not easily classified, and described and ethical considerations may preclude certain research strategies. Furthermore, research is expensive, and few if any public schools have the financial resources to sustain a major research effort. While the reality of these problems cannot be denied, it is still true that they must be solved if our knowledge of brain-behavior relationships is to be refined in ways to make is maximally relevant to critical educational problems.

The details of any research program obviously must be determined by the specific questions for which answers are being sought. It is not possible nor is it the intent of this paper to attempt to list all of the specific questions that must be answered if there is to be a union between our knowledge of brain-behavior relationships and concepts and practices in the area of learning disabilities. What has been attempted, instead, is the delineation of a broad area of knowledge and the delineation of broad problem areas so that a potential meshing of the two might be visualized. This meshing cannot occur, however, in the absence of an appropriate research-service model. Such a model must permit the longitudinal study of children with learning disabilities by pediatric neurologists, developmental psychologists, curriculum specialists, and classroom teachers. There must be a sufficiently large population base to permit selecting for study children with different kinds of developmental disorders. Initially, the research and service work could proceed on a relatively small basis, identifying appropriate curriculum material, specifying teaching methods, correlating the cognitive demands of the methods and materials with developmental assessment procedures, and studying patterns of learning in a few children. The subject base could then be expanded to include children of different ages and with differing patterns of impairment. The eventual products of this research would be "systems" of educational management including assessment procedures, procedures for selecting materials, and teaching procedures.

The kind of research program that is described above has, as its principal intent, establishing relationships between specific teaching procedures and the ability deficits and the deviant developmental courses which characterize learning disabled children. It has been stated earlier that this is an area of vast ignorance. This statement is not made lightly. It is made with full recognition that there are many people in special education who firmly believe that disorders of development can now be effectively treated with training programs focusing on basic ability deficits. The popularity of perceptual-motor training programs is strong evidence that the mental and motor dysfunctions of the learning disabled child represent critical problems for the classroom teacher. The effectiveness of such programs is still, however, largely unknown. Such programs have typically ignored refined assessment procedures, and they have diverted attention from commonly accepted educational goals. Perceptual-motor training programs should be carefully evaluated, and this is precisely what is not being done. Instead, such programs are packaged, exported, and applied under the claim of prima-facie validity. This claim will remain a substitute for careful research until the research is actually done.

It seems appropriate to conclude this paper by noting certain possible side effects of a systematic effort to explore the significance of brain-behavior disorders for problems in special education. One probable effect would be to strengthen a conceptual framework for problems in special education that could be readily shared by medical personnel. There has rarely been a fruitful alliance between medicine and education largely because a perspective emphasizing duties, responsibilities, and problems common to both disciplines has never been developed. It is clear, however, that both medicine and education focus on children who have learning disabilities, and both are important in the delivery of services. These commonalities need to be emphasized.

A second effect of the kind of research program being proposed could be to provide a conceptual framework that would help bridge the gaps between learning disabilities and other handicapping conditions. For example, educators have traditionally distinguished between mental retardation and learning disabilities, although the distinction is of dubious pedogogical value. Both conditions reflect disorders in brain-behavior relationships, both conditions can be studied with the same procedures, and the same critical educational problems invade both areas.

A third and perhaps less obvious consequence of the research program might be to help reduce the vulnerability of special education to political assault. The political vulnerability of current practices in special education is due partly to the questionable empirical basis for such practice, and partly to the fact that current ways of identifying handicapped learners emphasize cultural differences, thus resulting in over-representation in special education classes of disadvantaged racial groups. Perhaps, at this point in time, it would be wise to use procedures which reflect principles of biological organization rather than cultural organization and which thus emphasize ways in which diverse groups are alike rather than ways in which they differ.

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APPENDIX K

AN INFORMATION--INTEGRATION THEORY AND ITS APPLICATION TO NORMAL READING ACQUISITION AND READING DISABILITY

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In order to understand abnormal functioning, it would be useful to have a theory substantiated by experiments which describes the course and functioning of normal behavior. Such a theory together with its supporting factual data would allow us to understand precisely where abnormality is centered. By examining the functioning of the person thought to be disabled in some way we would be able to decipher where his performance varies from that of the normally functioning individual. Such performance differences would imply within the context of the theory processes or systems which are functioning irregularly. These processes or systems would then represent the focus of one's remedial effort.

It should be clear why a theory is necessary in this endeavor and that a collection of unorganized facts will not suffice. Most basically, one need recognize that there are an endless number of data points that one could collect that would discriminate between any two samples of persons. Understanding deviant functioning or any functioning for that matter proceeds not simply by having a large collection of data but by having those data organized into a coherent framework. A framework allows some data to take on more importance in understanding the disability than others by specifying the manner in which the data are related to each other.

Besides the basic function of organizing facts into meaningful relationships, theory is particulary important in understanding deviant functioning. To be recognized as meaningful deviant functioning, behavior need be abnormal in a manner which has profound consequences for the individual and likely also for his family and more broadly for society in general. The deviance, thus, ordinarily involves a large segment of the person's life. As such, the disability creates many differences that are not etiological or otherwise basic to the disability itself. Said most simply, deviance seems to breed deviance such that the individual given an abberrant manner of behaving tends to have this deviance affect many aspects of his life. Consequently, there are an endless number of ways in which the deviant individual differs from a person not so afflicted. The need for a theory is seen in the necessity to organize the atypical behaviors into a coherent, meaningful pattern. Without a theory, the enumeration of deviant behaviors goes on unchecked, resulting in a proliferation of constructs which complicate rather than illuminate our understanding. Without a theory, the constructs are frequently heavily overlapping and as such terribly redundant. Furthermore, the body of constructs has no specified relationships between one another. Hence, the deviant individual is thought to have a multitude of problems where an appropriate theoretical conception may show him to have only one basic problem with performance in other spheres aggravated by this specific deficit.

Recently, the area of learning disabilities, with which this paper is primarily concerned, has gravitated toward constructs familiar to information-processing psychology in lieu of the medical terminology which had not proven educationally meaningful. Terms such as selective attention, visual discrimination, auditory discrimination, visual perception, visual-motor functioning, sound blending, and the like cast the disabled learners' deficits within a psychological perspective. Rather than impute to the child genetic or organic anomalies, the field has chosen, wisely I think, to describe the child's disorder in terms of those underlying processes which limit his ability to utilize language. Though information-processing models represent only one possible approach, their simplicity and intuitive appropriateness for understanding educational disabilities more than justifies their selection.

The field of special education has encountered problems with the information-processing framework, however, which stem, I believe, from an unwillingness of persons in the field to accept the interpretive restrictions which any specific information-processing model will necessarily contain. Though the information-processing terminology has been accepted, the uniqueness of competing models has been lost and with it the interpretive power and research generating potential. Consequently, the field has fallen prey to the proliferation of terms which results when a theory does not guide one's thinking. There are notable exceptions to this general state of affairs, for example the adoption of an Osgood Linguistic Model which underlies the ITPA, but this is nearly unique in its adherence to a coherent framework.

An analysis of the attentional deficiencies of learning disabled children as is being undertaken here would require that we cast attention in a specific theoretical framework. Despite the work of the last ten years or so in the field of cognitive psychology in constructing models of attention and associated processes, I find no single model satisfactory for understanding the difficulties encountered by learning disabled children. Furthermore, I find the existing models lacking in a number of other respects including their inability to account for certain germane experimental data and their severely restricted conceptualization of the information processing capabilities of the human organism. I am thus offering an alternative model which I will first describe in considerable detail and then use to analyze the information-processing difficulties of learning disabled children.

BACKGROUND TO THE THEORY

Dissatisfactions with Present Information-Processing Models

My dissatisfaction with present information-processing models is in part philosophical: Viewing man as most of these models do as one who decodes sensory inputs, holds them for brief periods of time, stores some for longer term use, and then later retrieves these stored signals does not do justice to the complexity of the information handling abilities of the human being. It is not that I seek more humanistic terms but rather wish to provide a framework within which information-processing research techniques can be utilized to study the organism's broader capabilities.

The most basic problem encountered with existing models is their insensitivity to feedback and under-representation of the organism's active role in information-processing tasks. Information-processing models typically adopt the traditional view that man's behavior (responses) is a function of environmental events (stimuli). More recent conceptions (e.g., Pribram, 1969) have stressed the importance of the organism's internal state as well as its productive capabilities in determining the particular response that will occur. Though it is widely recognized that the state of the organism will affect its dealings with the external world, it has not been easy for psychologists to build this observation into their theories. What we want to conceptualize is the notion that each behavior of the individual becomes part of its surroundings by virtue of various feedback mechanisms. Man hears what he says, feels what he does, and perhaps most importantly, has verbal awareness of his own behavior. These self-perceptions provide a more continuous cue base from which to generate behavior than that afforded by the external environment. The organism's cue base plus the stimuli impinging on him provide the context for his behavior.

In addition to the general orientation of present information-processing models, I take issue with certain more specific aspects shared by most present conceptualizations. As each of these problems will be discussed in detail below, I shall only refer to them here.

Exclusive reliance on linguistic materials. First, I think many present models generally overlook or underestimate the uniqueness of linguistic stimuli, whether presented visually as graphic symbols or auditorily as spoken speech. In relying almost exclusively on such linguistic stimuli for their experiments, psychologists have generated data and associated models which may be limited in their explanatory power to linguistic materials alone. Not only may they be limited but they may be erroneous to the extent that linguistic material has properties not shared by other kinds of information.

Our notions of attention within an information-processing context is a case in point, deriving in large part from experiments with linguistic materials. The early Cherry (1953) and Broadbent (1954) experiments together with the model derived from this line of investigation (Broadbent, 1957, 1958) led psychological researchers to ask whether attention were unitary, to be deployed totally to a given signal, or divisable, to be shared if necessary between two or more signals. This basic question about attention had distinct implications for the processing of information: Were attention non-divisable, simultaneous reception of two distinct streams of continuous speech would not be possible. A person interested in both speeches going on simultaneously would need to switch his attention back and forth from one speech to the other. By utilizing the redundancies in speech and by carefully timing one's attention to each speech, one could grasp most of the meaning and perhaps have the impression of having listened to the two conversations at the same time. The opposite conceptualization, that attention can be divided between two incoming signals, purports that information can be processed in parallel, that is two streams at the same time. This issue of whether attention is unified or divisible and the associated question of whether information is processed sequentially or in a parallel have occupied the time and energy of psychologists for a number of years. As I shall make clear below I think both of these are pseudo-issues, born out of a conceptualization of information-processing derived from and limited to the study of linguistic material.

Auditory decoding of linguistic material. A second problem with present information-processing models is their assertion that language decoding operates through an auditory-verbal-linguistic process. It is generally held, although recent experiments contradict this notion (Parkinson, 1972), that linguistic stimuli are translated to an auditory code for storage. This is not to say that people sub-vocalize as they read or that they repeat to themselves what the speaker is saying, Rather, it says that the code in which these linguistic events are stored is the same code from which the person generated his own language. There are excellent data supporting the position that linguistic stimuli can and frequently are auditorily coded. A prime example is the research on auditory confusions by Conrad (1964) in which he has shown that errors in recalling visually presented items are more similar in sound to the correct item than in shape. The implication is that the graphemes are auditorily coded such that any intrusion errors that result are more likely to sound rather than look like the correct grapheme.

Of course, demonstrating that visual graphic symbols are frequently and under a variety of conditions auditorily coded does not assure that they always are or can only be auditorily coded. Particularly when one considers that in most psychological experiments the subject is required to recall the items presented to him else the psychologist will have no data, he may be prompted to translate visual items into the auditory code appropriate for their output. There may exist a wide variety of conditions in which a person is not so prompted to translate visual graphic symbols into an auditory representation. One such example might be in reading; the accomplished reader may be able to recognize directly the meaning of a pattern of graphic symbols without first translating those graphic symbols into their auditory representation. As recent research (Parkinson, 1972) has shown that purely visual coding of graphic symbols is possible, a revised information-processing model is required.

Fragmentation. A third problem with present models which a new information-processing theory should correct is the fragmentation of information and the derived experiences that is implied by the unified notion of attention. Were we truly to pay attention to only one thing at a time, our experience and the resulting memories of those events would be terribly barren, uni-dimensional. Models which require one to pay attention to a given signal in order to process it put themselves in the position of being unable to account for the richness of immediate experience. Rather than accepting models which implicitly fractionate experience by requiring that channels of information be dealt with only sequentially by the organism. I think we would do better were we to tackle the issue of how to conceptualize man's tremendous ability to integrate a variety of sensory inputs. By implicitly limiting their purview to verbal stimuli (though many do not recognize this restriction) and by finding that as a result of the study with linguistic stimuli that material normally is processed sequentially, information-processing models falsely escape the issue of how, under normal circumstances, so much information seems to be gathered and stored as a unitary experience. An example may clarify the issue: one's walk through a garden on a spring day is not recalled as a sequence of colors, shapes and movements or the sensation of one's own body but as a total experience, a combination of these many impressions. Certainly it is possible that the combination of these sensory impressions occur sometime after their reception and that, as the present information-processing models imply, their reception was accomplished sequentially. However, this does not meet with our immediate experience. More important though, our present models don't address the issue at all. As will become clear below, I believe that the integration process occurs during the reception of the events rather than after their reception in memory. Regardless of one's conceptualization of this specific issue, we do need a model which can deal with the integration of sensory events into unified experiences and memories such that researchable predictions can be made and evaluated.

In summary, I seek to expound a model of information-processing which will do justice to the complexity of man's information-processing abilities including a recognition of the power he achieves by using the cues of his own behavior (sensory feedback, his own language system, and other internal cues) to provide a cue base from which to register and respond to incoming stimuli. In taking into account man's feedback mechanisms, the model also must deal with the response aspects of the system, namely verbal and motoric behavior. It seems terribly optimistic to have considered as our present models do that the response system has no integral relationship with the information-processing system under study. We know for example that the motor system is extremely important in perceptual development whether one recognizes this fact from an experimental work of Held (1965) or by the more theoretically-oriented work of Piaget (Flavell, 1963). It is likely and comes under question within the context of the model proposed that there exists intimate relationships between the sensory input and motor output systems. The basic realization that it is the same person involved in the input and output and that because of this fact the same limited capacity which gathers information about the world must act on the world requires that we include the output system in our conceptualization of information-processing. In addition to being sensitive to the feedback systems which man possesses, the proposed model also seeks a resolution of the issue of whether attention is unitary or divisible and the related issue of whether information is processed sequentially or in parallel. The model also addresses itself to the issue of whether visual linguistic stimuli need to be coded auditorily and, further, provides a framework within which to study inter-sensory integration and the integration of sensory input with stored material, i.e., incoming stimuli and "thoughts" and as such provides the rudiments of a model of creative thinking.

The Important Role of Attention

Attention has been one of the most illusive constructs with which psychologists have dealt. Though currently popular, being studied by experimental psychologists and prominent in the thinking of health science practitioners, attention was all but absent from experimental psychology in the second through fifth decades of this century. Perhaps because of its mentalistic flavor and to some extent certainly because of its difficulty in being operationalized, attention was shunned by S-R Psychology and more broadly by those of a behaviorist persuation. With the increased interest in cognitive psychology during the past two decades and with the advances in the psychophysiological measurement of attention (the orienting reflex) (Maltzman & Raskin, 1965; Sokolov, 1960), psychologists have once again tried to deal in a formal manner with attention.

The importance of the function of attention cannot be minimized; if one concedes that one need attend to material in order to receive it, it follows that all of our experience is in part determined by the workings of the attentional mechanism. In a very basic sense, you are what you attend to. It is no wonder that cognitive psychology in its interest in examining how the organism receives, transfers, stores and transmits information has actively wrestled with the construct of attention.

The intermittent use of the concept attention, however, causes one to question whether its inclusion is altogether necessary in one's theory. To what aspect or aspects of behavior does the term attention refer? There are at least five characteristic behaviors which have been described in terms of attention. They are: 1) alertness, 2) selectivity, 3) vigilance, 4) preparatory sets, and 5) attentional deployment. Alertness is generally taken to mean the quantitative component of attention, how "hard is one paying attention." Selectivity refers to the content of attention, to which of all the possible cues does one choose to attend? This aspect of attention can refer either to the receptor orienting acts, that is, the direction one orients one's receptors, or to the selection of information internally from the information presented to the organism, as for example, the selection of a person's face when much more information than the face alone is present on one's retina. Vigilance refers to the persistence of attention for a given content. Set refers to the preparation for responding, rather than for attending to a specific content. Attention deployment refers to the set of rules which determine what the organism attends to. Does one tend to look more than listen, to look at colors more than shapes, does one look at moving things or hear loud noises above all else and so forth?

It is to be noted that all of these dimensions of attention refer to some aspect of information. Alertness refers to the preparation to receive information, selectivity to the specific information being received, vigilance to the persistence with which given information is processed, set to the preparation for selecting a certain type of information, and attentional deployment to the set of rules which determine what gets processed. Is it possible that the term attention is superfluous?

Dropping attentional terminology. Can we omit the word attention and redistribute to various aspects of an information-processing system the functions subsumed under the term attention? I propose that the terms we have used to describe attentional processes derive from our own immediate experience of processing information and as such are superfluous, redundant with processing itself. What we perceive of as our own attending is our own processing. Equating information-processing itself with the terminology of attention would represent a simplifying assumption. Take for example the question, "Can one process something to which one has not attended?" or conversely, "Can one fail to process something to which one has attended?". Though these sound like meaningful questions, with our simplifying assumption they become "Can one process something which one has not processed?" and conversely "Can one fail to process something one has failed to process". Obviously, these latter questions have little meaning and reduce to rather absurd identities. While making assumptions does not directly answer questions, the unique outlook provided by the equation of attention with information-processing itself will, I believe, prove fruitful. The ramifications of dropping the word attention in favor of information processing will become clear in the model described below. At times, I shall state issues both in terms of the information-processing language of the model and in more traditional attentional terms such that the reader will clearly see the change in focus provided by the change in terminology.

Limited capacity assumption. A second basic and likely less controversial assumption is that the organism has limited capacity with which to process information. This assumption has been around a long time, the most widely used construct being that of "limited channel capacity" (Broadbent, 1958). (Inasmuch as we have considered attention to by synonymous with information-processing, it would be redundant to postulate that attention as well as processing capacity is limited.) Because the information-processing capacity is limited, the organism must select which information it will process (attend to). Though an obvious notion, the assumption that the processing system has limited capacity has very important ramifications for the distribution of this limited capacity. Improper management of an adequate amount of information-processing capacity can result in failure on certain tasks just as severe as that caused by limited capacity itself. The paradox of learning disabilities may find some resolutions in this notion. Though not mentally retarded, presumably a condition represented by limited capacity, the learning disabled child has adequate resources, i.e., processing capacity, but seems unable to achieve the desired complex behavior, as for example reading. As will be made clear following the elucidation of the model, it is likely that many types of learning disability result directly from inappropriate processing.

The Nature of Information: An Overview

As used throughout, information refers to the various signals which the organism is capable of decoding. By decoding is simply meant the ability to make discriminative responses to the given information if necessary. Thus, the notion of information as used here carries with it an implicit statement about the organism's capabilities. What is information for one organism may not be for another. For example, a physician with considerable training is capable of reading subtle shading patterns on an x-ray which are indiscernable to the untutored eye. Though the information is potential on the retina of the naive observer, for it to function as information, the organism must be able to form a discrimination between the pattern of neural activity evoked by differing distal (external) stimuli.

Information as patterned neuro-chemical events. It is implicitly assumed that the raw data of information which serve as proximal stimuli consist of neuro-chemical events. It is further assumed that the neural events are read, i.e., interpreted, by the organism in broad patterns; it is a certain patterning of neuro-chemical events which represent the true proximal stimulus for resulting behavior. This point will be reiterated later but I wish to stress right at the outset that in not making our concept of information explicit, we have implicitly assumed that information mirrors our experience of external stimuli, that information is an integral event just as external stimuli are perceived as integral events, an L, a glass, a picture and so forth. Such thinking is insensitive to the likelihood that the objects we perceive as being in the environment are constructed from fragmented sensory data. Take for example a box. The information we process is not "a box" but a pattern of lines, angles, colors which throughout our experience we have become able to recognize as corresponding to an external object which we labeled "box." The information we are dealing with remains a multitude of neuro-chemical events, the patterning of which we have learned to associate with the label and associated meanings of the external object. We shall consider this point again below when considering the basic informational units, the analyzer output.

Heirarchy of information. A second aspect of information important to the present model is its assumed hierarchical character. Given the conceptualization of external events as repeating patterns of neuro-chemical events, one can readily conceive of some external events involving more complex patterns of these more basic units. Complexity may derive both from the number of individual units making up the pattern or the number of different types of units making up the pattern. The notion of types of units is considered under the heading Analyzers. Viewing objects or events as patterns of various numbers and types of informational units, one is quickly led to the realization that some objects or events can be recognized very simply by virtue of their being transmitted redundantly with few units of information while other events or objects require more units to make up the pattern.

One can relate this aspect of information to the concept of information within an information theory framework (Attneave, 1959). Imagine a visual display board made up of small lights which could either be on or off. The amount of information in a stimulus is given by the number of lights that have to take on their appropriate on or off state for the observer to recognize the object. Thus a circle can be represented by relatively few of these lights taking on a specific on or off state while the corresponding visual grapheme corresponding to the word circle would require many more of the informational units taking on a specific state. The first letter of the word circle itself represents a more complex form-decoding task than is the recognition of the object to which the whole word refers. Thus, the picture of a circle is more easily recognized than the written word circle, by virtue of there being less informational units necessary to construct the object than to construct the written word. This example illustrates the likely general case that spoken and written speech represent two of the most demanding information-laden sets of stimuli. The important general point to keep in mind is that recognition flows from a specific patterning of informational units, allowing for minor stochastic variation in each unit. A pattern, not a unified event, is registered. Various stimuli presented to the organism require more complex patterns for their recognition than do others and hence some information is more difficult to decipher. Deciphering linguistic information, even with the redundancies of language, constitutes an analysis of patterns composed of an exceedingly large number of informational units.

Parallel Versus Sequential Informational Processing

In order to place this discussion more clearly in the context of modern cognitive psychology, let me point out the ramifications of the present conceptualization of information for the issue of whether information is processed sequentially or in parallel. Recall that this is also the issue of whether the human observer can pay attention to more than one thing at a time. Were he able to pay attention to only one thing at a time, information would necessarily be processed sequentially. Were he able to divide his attention, he would be able to process information in parallel. Although we at times feel we can listen to more than one conversation at a time, it is possible that all we are doing is rapidly shifting our attention back and forth from one conversation to another. Said in the terminology of the present model, all we are doing is alternately processing two streams of information. The redundancies in the language would allow us to predict, i.e., to fill in, what we do not actually hear.

The many experiments which have addressed themselves to this issue have found that for the most part processing of semantic material can only proceed sequentially, one message at a time. These experiments ordinarily utilize the dichotic listening paradigm in which two messages are simultaneously input to the two ears, a different message to each ear. To assure that the subject attends to (processes) one of the messages, he is required to repeat verbatim that message immediately after he hears it (shadowing). Upon stopping shadowing, he is required to relate as much of the information from the unshadowed ear as possible. Ordinarily, the subject is unable to recall any of the content input to the unshadowed ear, except the most immediately presented material if the two messages terminate at the same time. He is able to decipher whether the unattended message was presented in a high or low pitched voice but is unable to determine even whether the message was spoken in his native language.

The fact that the unattended message is not totally ignored has created some problems for information-processing theories like those of Broadbent (1957). The subject's being able to determine the relative pitch of the voice in the unattended ear and other demonstrations showing that some processing of the unattended message is occurring do not provide us a clear choice between the parallel versus sequential processing models. While it appears true that two semantic messages are not simultaneously understandable, it is also true that one semantic message can be coded while other aspects of the unattended to channel are also processed. It would be a terrible over-generalization to claim that all information need be processed sequentially just because two semantic messages appear to have this limitation.

In the present thinking information is thought to be distributed hierarchically with semantic material requiring considerable information-processing capacity while less complex (highly redundant) information, such as the registry of the physical features, pitch, requires less processing capacity. Up to the point where the processor's capacity is reached, information is seen according to the present model as streaming through in parallel. At the point where processing capacity is reached, selection of input becomes more critical. The dichotic listening situation, where two semantic messages are input simultaneously to each ear, represents a case where processing capacity is exceeded such that selection of one input over the other is required. As another example imagine one is standing examining a picture and another person engages you in conversation. Though you may have to stop examining the picture as carefully or feel yourself withdrawing resources from the visual analysis of the picture to attend to (process) the vocal input, one need not totally ignore (stop processing) the picture. Nor need one sit down to begin the conversation even though continued processing of kinesthetic feedback is important in maintaining one's balance.

Simultaneous processing is the rule rather than the exception. It is because we are so often dealing with complex semantic material that the issue of selective attention becomes so critical. Because semantic material requires so much of our capacity, dealing with this material frequently puts us in the position of having to reject inputs to which we would otherwise attend (process). Thus, the issue is not whether the organism processes information in sequence or in parallel but more simply what information gets processed at all given that not all of it can be processed. Thinking of various signals as requiring various percentages of one's total information-processing capacity, one can consider the ramifications of trying to process a message requiring 75% of one's capacity while simultaneously trying to process another message requiring 60% of one's capacity. If one favors the former one is left with only 25% capacity with which to register the information in the other message. Though this can be done in parallel, such a small percentage of the capacity is not sufficient to decode semantically the message requiring 60% of one's capacity, though capacity to register physical features does remain. If for one reason or another, one chooses to set for himself the task of deciphering both messages, he will have to share his capacity between the two messages and will experience processing sequentially.

As an aside, note here how the reliance on information-processing instead of attention deployment absolves one of the necessity of having to postulate that greater attention need be deployed to decode more complex information such as semantic messages. In this way of thinking, the greater attention we may experience in processing more complex information may merely be an awareness of a greater portion of our capacity being devoted to the task.

In summary, it would appear that the research paradigms utilized in studying attention and information-processing represent a limited, though certainly an important, information-processing situation. This is the special case where verbal information is being input simultaneously. The issue of whether other kinds of information besides verbal information can be processed in parallel is not determined by these studies. With the notion that information is arranged hierarchically (some events requiring more of one's capacity to decode than other events), one is free to construct a model of information-processing which allows one to utilize one's total capacity, analyzing information in parallel up to capacity level after which more careful selection of inputs is required. Such a model is described below.

THE MODEL'S COMPONENTS

Analyzers

Analyzers are receptor and neural cells acting in combination which provide unit information by which the external world is known. The analyzers carry the unit information to which the organism can differentially respond. An analyzer is not a receptor cell per se though a single receptor cell could logically function as an analyzer. Rather, receptor and neural cells can more typically act in combination to provide unique information about the external world. Each analyzer responds to a different aspect of the external stimuli. As used here, the term analyzer is synonymous with the basic unit cells discovered in recent years. Examples of these cells are line detectors, edge detectors, moving edge detectors, slant detectors, color detectors, movement detectors and so forth.

An exhaustive enumeration of the various basic analyzers is not presently possible, nor is the issue clear as to whether these basic analyzers all represent innate capacities of the organism. While it is highly likely that many of the basic analyzers are innate, it is also possible that early experience provides a necessary condition for the growth of some analyzers which are formed from more complex combinations of sensory receptors and neural cells. The issue is more properly of concern to neurophysiologists than to the level of analysis with which the present information-processing model is concerned. What is most important here is that the signals with which the organism deals are composed of unit information from these basic analyzers.

The analysis of informational patterns referred to previously is based on these analyzers which provide unit information making up the complex pattern. Thus, as is more clear now that analyzers have been introduced, informational patterns can vary by virtue of the total number of analyzers involved in defining the pattern produced by some object or event and in terms of the number of different types [illegible] analyzers required to convey the meaning of that external object. From the point of view of the present model, the total number of units of analyzer activity required to convey the information is thought to be more important than the number of different analyzer types involved, though this issue is considered further when the problems of forming channels of information from these basic analyzers are discussed.

An interesting developmental issue concerns whether some of the analyzers are more basic than others, thereby forming a hierarchy of analyzer inputs. It could have important ramifications for perceptual development were different organisms to have different priorities with which information were transmitted to higher centers. However, these issues are not specifically germane to the present discussion.

Channels

Our conception and immediate experience of our environment is no where near as fragmented and detailed as would be suggested by the workings of the analyzers alone. Rather than edges, moving edges, angularity, specific movement and the like, our experience is integrated into larger units. These larger units of experience are termed channels. The major importance of channels is that they are the basis of our ability to process selectively portions of our environment. By forming larger units made up of various kinds and numbers of sensory analyzers, the organism acquires the ability to dimensionalize his stimulus environment; this formation or construction of the environment into larger units is a necessary first step in allowing the organism to inhibit processing portions of this stimulus environment in favor of processing other portions in more detail. In forming hierarchical units from the more basic analyzer information, the organism is able to inhibit the firing of all the component analyzers for any given channel.

There are two basic types of channel formation that need to be considered: first is the channel formation that takes place within a developmental context. From the basic analyzer information, how does the developing organism come to construct the channels that it does? Second, at any given time, how does the organism constitute from the information available from the analyzers a channel, discontinue that channel and reconstitute another one? Though these two types of channel formation may appear distinct, they are mutually interdependent as the selection of one aspect of a stimulus field presumes the previous development of the channel groupings utilized in that selective enterprise. I shall deal with these two issues in turn.

Channel development. From the data the analyzers provide the informational array (discussed below), the developing infant begins to recognize the repeating nature of patterns of analyzer firing. These regularities in the firing of the various analyzers are, of course, correlated with the presence of distinct and likewise repeating objects or events in the environment. Thus, an object in the visual field, for example, becomes known by the repeated pattern of firing of the analyzers responsive to the various dimensions of the object. Recognition of any given object then is not so much an issue of an exact duplicate "recognition response" so much as it is whether a sizeable enough portion of the total responding analyzers form a pattern sufficiently like that when the object was previously presented. Slight changes in orientation, in lighting, and so forth may initially be sufficient to cause the organism not to respond in the same manner to the object as it did previously. However, with repeated exposures, the recognition of the object becomes based on a much broader and more complete pattern of analyzer firing. What is stressed here is that the recognition response is based on the "reading" of a large pattern of information and hence minor variations in the pattern can be tolerated without failure of the recognition response to occur. As we shall see below, this view of stimulus recognition, as a process of interpreting patterns of analyzer firing, has distinct implications for traditional visual search and pattern recognition experiments. As will be detailed more thoroughly below, the process by which analyzer data are pooled and the regularities in the pattern of analyzer data recognized is termed integration. I choose this term because it implies a constructive nature to the recognition learning (stimulus learning) process. It is as though from the total information available about the object or event, the organism learns to read that pattern of input which hangs together in time and over repeated trials. For accurate and thorough knowledge of any object in the environment, the organism needs to pool information across basic analyzers from many input sources. This is the process of integration.

An important issue is the relative contribution of the organism's endowment versus his experience in forming channels. The process of recognizing repeating patterns of neural data from the analyzers in itself requires no assumptions about the inherent meaning of these signals; the organism could construct a conception of the object or event simply from the repeating patterns, the elements of which having previously acquired meaning through past integration. However, the physiological evidence of basic analyzer types such as line, edge, moving edge detectors and the like argues against such a "blank slate" view. While this model still contends that it is the reading of patterns of analyzer data which is critical to understanding and recognition of the external world, the notion of analyzers inherent in the model is that they can provide and do provide rather specific information about the nature of the external object. There certainly is not space here to disentangle the philosophical issue of whether the organism truly does begin as a "blank slate" or whether there is such a thing as innate ideas. I am simply suggesting that a combination of the two positions seem tenable from the present data, that is, that the firing of certain analyzers has inherent meaning but that the patterning of these analyzer data has to be learned (integration) of the organism is to know its environment.

Given that we are positing specific types of analyzer data, we must allow for the possibility that there are individual differences in the type of analyzers that have ascendance from one organism to another and that within any organism the likelihood of a given type of analyzer transmitting data successfully to higher centers for analysis is given by its relative position in a hierarchical ordering of the analyzers. This is only to say that one need not make the assumption that at or around birth, the transmission of all analyzers is equally likely. Though a fine point to some extent, the notion of a hierarchy of analyzers has critical implications for determining the total impression the organism will have of any given external object. This point is made clearest by extreme cases where sensory impairment occurs: deaf children, for example, would be expected to have a very different total impression of a rattle by virtue of it being void of the auditory dimension. One can readily see that the number of questions suggested by this conceptualization of the perceptual learning process are immense and call for a more detailed statement of the nature of the integration process named above. I shall put off this task until after the model's components have been described.

The integration process by which regularities in the input from many analyzers are recognized works in conjunction with inhibition. Inhibition constitutes the mechanism by which those analyzer data which are not repeatedly correlated with a given object or event, i.e., constitute random variation, can come to be ignored (not processed). This inhibitory process likely does not work on each analyzer individually but is able to function on classes of analyzers. Such an assertion certainly does posit a specific anatomical organization.

Specifically, it is required that data of a given type, for example, data from a moving edge detector, need be organized in a relatively few locations so that the inhibition of information from the moving edge detectors can be efficiently inhibited. It becomes a question for basic physiological research to discover how the basic analyzers combined to provide data and at which loci in this combinatorial structure inhibition is physically possible. A likely possibility is that there is a hierarchical taxonomy of analyzers which allows the organism through an inhibitory process to suppress the firing of large classes of analyzers. For example, movement detectors of all kinds may be related in such a way that the organism can temporarily become less receptive to all movement in the visual field. Similarly, color may be inhibited. Or, alternatively, certain portions of the color spectrum may be able to be inhibited independently. The central point here is that a structural organization of analyzers, taxonomic in nature, is hypothesized to exist and that this hierarchical organization allows the organism to suppress large portions of potential data. Whether the hierarchical organization is built up through experience with certain objects in the environment or whether this hierarchy is initially part of the anatomical under-pinnings of behavior certainly requires detailed study.

Channel formation. Within the context of the present model, perceptual development heavily involves the organization of analyzers into channels appropriate for recording the objects and events that intrude upon the organism and later those events that adults and society have highlighted for particular analysis. At any given point in time, the organism can select from the channels potentially available to him that which he wishes to analyze. Depending on the task the organism sets himself, the channel will be more or less broad, that is, will contain as figure a variable amount of data. In selecting a given portion of the stimulus field for more detailed analysis, other portions of the information being analyzed need to be curtailed given that the organism has limited processing capacity. To illustrate, the level of information extraction pertaining to the location and speed of moving automobiles requires greater capacity than is generally devoted to them as one walks along a sidewalk. Consequently, upon reaching an intersection, one must restrict processing other events, for example the conversation with one's companion, in favor of analyzing the critically important velocity of passing automobiles. Though the person need not totally fail to process a given class of analyzer information, e.g., passing automobiles, neither can he process it maximally given the concurrent demands on the processing system the conversation represents. However, when those data become more relevant to the organism, e.g., at the intersection, he can redistribute his inhibitory capabilities in order to devote a larger portion of his processing capacity to the more critical information at hand. At this point in time, one's speech output and understanding will have slackened as information about the passing cars is analyzed.

Articulation. Articulation is the process of forming informational channels. A person with extremely broad processing (global attention) experiences the world passively, while the person with discriminating processing asserts more control over his perceptions. Articulation can be extremely fluid, the person being able to group and re-group analyzer data through differential use of inhibition.

An example will illustrate how the same information source can give rise to different channels. Let us look at what kinds of channels a person could form in the visual modality. Examining the environment around him, one could identify a central object in the field such as a chair. One can further distinguish the chair's color, the chair's form, and even get a kinesthetic feel for how heavy the chair is. One can further analyze in terms of the diagonal one feels in the chair or its verticals or how straight and stiff it appears, and so forth. One recognizes how articulated this description of a chair has become. Such articulation depends on one's ability to process the relevant analyzer data while inhibiting others' even though also evoked by the same chair. Alternatively, the chair could be treated globally, processed only to the point and only along those dimensions necessary for generating sitting behavior. This articulation ability may be extremely critical for intelligence and creativity in general. It is an ability to see the environment in various ways; because one is able to look at the various channels sequentially, one can become responsive to more aspects of one's environment than would be possible were one to deal with the total stimulus on each occasion.

To be certain that this point is understood, let me clarify the argument further. Given that the processing system is assumed to have limited capacity, only so much information can be deciphered at a given time. If one is able to isolate certain portions of the information into a separate channel and then analyze that channel exclusive of others, the detail of information that can be processed will be much greater than if the broader channel information is filling the processor. Thus, in the chair example, though we do not generally analyze a chair sequentially in terms of the various subcomponents of that chair, we can do this and learn much more about the object in so doing. The critic of art most certainly is well-versed in this technique. The present model posits that the critic's detailed appreciation comes from a considered examination of aspects of the stimulus that could not be possible were the total stimulus dealt with at the same time. Thus, while the global view is efficient, it does not lead to a careful consideration of all the information available. One requires the ability to form finer, more articulated channels which can then be processed more completely to the exclusion of other information to gain more articulated knowledge.

The global view has the greater disadvantage not simply in providing less information but has the added disadvantage that this superficial information leads to more rapid satiation (disinterest). Consequently, the person is required to look elsewhere for something to interest him. The success of the orienting behavior in finding new stimuli of interest will likely reinforce these tendencies to shift processing (attention) rapidly and hence reinforce a pattern of processing that is quixotic in its treatment of the information potentially available. Conversely, the child able to form more highly articulated channels avails himself of more information and will utilize these finer channels to the point that they prove useful or continue to be stimulating to him. (The apparent circularity of this final assertion is recognized but will later be shown not to be circular within the proposed model.)

The general point one need keep in mind is that the information potentially available is the same or nearly so for all observers (except for cases of organic damage). The fact that one takes a highly global stance indicates his disuse of much of the information and its subsequent inaccessibility for him. Were he able to eliminate from considerations some aspects of the environment in favor of some smaller set, his understanding would become more articulated.

Summary. Channels are the collection of analyzers which are processed as a set; as such, various analyzers at times may be components of different channels. Channels are continuously constituted, discontinued, and reconstituted. The amount of information one can transmit over any given channel is determined by the organism's central processing capacity. We can either process less detailed information about a broad information channel as when taking in the arrangement of a room or we can analyze a portion of that room in more detail and hence in more depth as when we examine a specific picture hanging on the wall. In the first case, our channel is very broad but lacks detail where in the latter case it sacrifices in breadth what it gains in clarity and depth of information extraction. The types of channels the organism develops are likely a joint function of the hierarchy of initial analyzer output to the higher centers and the organism's experience and reinforcement history, this final point being considered further below. The training variable may be as important as the organism's more basic endowment. A child who has found a global style acceptable may in a very real sense make the more articulated information potentially available to him less available than it is to a child without the experience of rejecting this finer level of analysis. From the channels potentially available to the organism, it selects some of the information as central of "figure" by inhibiting those analyzers not deemed relevant to the extraction of the figure's information. Through either the natural hierarchy of the analyzers or through a developmental process, the inhibition of various analyzer-combinations becomes more efficient, thus allowing more rapid processing shifts from one channel to another.

Informational Array

The informational array is the central concept of this theory. The informational array can be likened to a television picture tube or photographic paper in that it consists of a myriad of elements which can take on different informational states. The observer interprets this information not through a point by point analysis of each informational unit but by a more global patterned reading of the information. Models which implicitly treat information as though it were a single stream of neural signals have been misleading. Recognizing that most of the objects or events to which the human organism responds are sufficiently complex to require the firing of huge numbers of neural cells, it is more likely that the process of recognition involves the simultaneous reading of a huge collection of varied, basic analyzer data. Recognition is based not on the presence or absence of a single element but on a more stochastic process which requires the analyzer data to be only a reasonable approximation to the neural data previously aroused by a given stimulus. Some variation in analyzer firing can be tolerated while still allowing the organism to recognize accurately the object as being the same. The degree of variability, some due to the unreliability of the neural system itself and some to the actual variability in the external object, and the organism's practice in recognizing the stimulus in varying contexts will determine whether correct recognition occurs. Thus, in a very basic sense the organism recognizes a highly complex pattern of basic analyzer data, not an object. This basic distinction has critical implications for one's whole view of information-processing.

Array Size. Array size is limited in recognition of the assumption that processing capacity is finite. Therefore, it is of critical importance what information the organism allows to fall on its informational array. Though one may have a large capacity, i.e., a large informational array, efficient information-processing requires that the task-relevant information comprise a high proportion of the data on the array. Because the organism needs to select the appropriate information for task solution, a large informational array alone is no guarantee of adequate information processing.

The major point about array size is not so much that it varies from one person to the next, but rather that it is always smaller than that required to display all of the information being gathered by the organism's sensory system and certainly smaller than that required to display the information the organism has stored. Thus, it is important to recognize that the informational array corresponds to that information which has effects on the organism's behavior (is being processed), not that which is being received by the sensory system. However, in making this important distinction, I wish at the same time to make it clear that what is being processed is not synonymous with what the psychologist calls his stimulus materials. Recall that the present model posits that up to the limit of one's processing capacity (array size) information can enter the array in parallel. Thus, a person encountering a verbal stimulus, while likely having that information represented on a portion of his array, will not necessarily have to eliminate all other information. For example, the feedback from his own musculature, random noise in the testing situation, thoughts, either task-relevant in the form of self-instructional strategies or task-irrelevant, may be part of the organism's informational array from time to time. Consequently, the information available to the organism at any point in time, i.e., that present on his informational array, may be highly complex and drawn from many sources. Positing as this model does that information is organized and analyzed as patterns on the informational array, the model opens up tremendous possibilities for understanding complex synthetic behavior. This point will be re-introduced later.

The informational array in containing analyzer data drawn from many sources is consequently in a continual state of flux. Obviously, the rules governing the change in the information allowed onto the informational array from one moment to the next would constitute the most basic information-processing issue. Note that this issue is essentially the same as that of attentional deployment, that is it asks from one moment to the next to what will the organism attend. However, I believe the direction one looks for answers to these two questions would be different.

Basic Functions of the array. The notion of an informational array is critical in that it represents the organism's immediate cue base. It is the true proximal stimulus. As such it is critically important in determining the contents of subsequent informational arrays and hence provides continuity to the organism's behavior. This point will also be re-introduced later and become clearer following a more complete description of the contents of the informational array. Second, the notion of an informational array is important for it provides a mechanism for intersensory integration. As Birch has frequently pointed out (Birch & Lefford, 1963), the human organism's exceptional information-processing capacity is distinguished not by its possession of any individually strong sense capability but rather by the ability to gather information from many sensory systems and derive a synthetic understanding of his environment. Integration will be discussed below but the reader should note at this point that the informational array provides the mechanism for the simultaneous reception and response to data arriving from different sensory sources.

Further, the notion of an informational array provides a mechanism for the synthesis not only of sensory data but for the unification of sensory data with that already stored. As noted below, the informational array is capable not only of receiving input from sensory sources but also from storage, thus allowing the possible integration of new data with that previously received. The informational array, serving as a central hub, organizing the organism's behavior, opens up many new questions concerning the functioning integrity of the human organism. These later possibilities will be described following a discussion of the contents of the informational array.

Contents of the Information Array

A description of the contents of the information array needs to be artificial in that the informational array is continually in a state of flux. Consequently, no single description ever holds true. Thus, what I shall describe here are the kinds of data potentially capable of simultaneous presence on the array and caution the reader to recognize that all of the possible information is typically not on the array at the same time.

There are four major types of information which can fall on the informational array. These include (1) sensory analyzer data, (2) feedback and efference from the motor system, (3) bodily sensations other than the five senses and (4) mentation. I shall describe these in turn.

Sensory analyzer data. Informational-processing models normally restrict their applicability to the processing of sensory data. The present theory is concerned with these data also but in a somewhat different manner. First, as has been noted above, the sensory data received by the organism constitute more than those labeled stimuli within the context of a psychological experiment. It is recognized, for instance, that distraction signals, "background" cues, the subject's need state and thought process may all be represented on the informational array even though they may not be relevant to the information-processing task at hand. This assertion provides a framework within which to understand experimental paradigms which require so-called divided attention. Consider the incidental learning paradigm: whether or not incidental data are processed will depend upon the organism's mechanisms to make the processing of the subject-defined task-relevant information maximally efficient. If the incidental material is not inhibited due either to S's inability to apply the necessary inhibition or to his definition of the material as task-relevant, his "incidental recall" will be high. Thus, as the organism gains inhibitory control over material he sees as task-irrelevant, his "incidental recall" will drop. The issue is less one of divided attention than that of understanding the task and being capable of applying the appropriate inhibition to irrelevant material such that maximal array space is given over to the central task (cf., Maccoby & Hagen, 1965).

A second example of a paradigm dealt with in attentional terms which can be alternatively understood within the present framework is the shadowing procedure within the dichotic listening paradigm. The present model assumes that the array size is too small to represent the neural patterning corresponding to two verbal messages. Consequently, information from the unshadowed message is not allowed sufficient space to be semantically decoded, though the more basic aspects of the signal, for example its pitch, is discernable. Any portion of the unattended to signal will be sufficient to determine its pitch quality while a much more thorough analysis of the array patterns is necessary to discern its semantic content. Attentional switching models have had difficulty explaining why any of the unattended to material is received. Solutions to this problem have taken the form of attenuaters attached to the unattended to channels. The present model is more in agreement with these notions but circumvents the need to introduce attenuaters by positing a parallel processing system with limited capacity. Paradoxically, in this instance where the subject is instructed to attend only to one ear, reception of the pitch qualities of the unattended to message constitute more a failure of the inhibitory process to keep the unwanted material off the information array than it does the achievement of so-called "divided attention."

The capacity of the normal human organism is such that the content of the sensory data on the informational array is highly multimodal. One need not shut one's eyes or block one's ears or reduce kinesthetic cues by attaining a resting position in order to process material through a given sensory system. We know monitoring of (so-called) unattended to signal can occur as evidenced by our ability to note stimulus decreases in these sensory systems when they occur. Also, certain words of high signal value such as one's name or simple tones the *S* is cued to expect are registered even in the "unattended" ear. It would appear more parsimonious (and consistent with the present conceptualization) to hypothesize that these exceptional stimuli processed in the "unattended" ear require very little array space and hence can be processed in parallel with the shadowed message. Increasing shadowing demands or the complexity of the signal in the unattended ear as by requiring that the *S* search for the word "tone" rather than an actual tone should result in reduced reception in the unattended channel. Other predictions are possible. The important point, though, is that the processing explanation is much simpler than the attentional one while still being able to account for the phenomena. Second, routine input constitutes noise in the psychophysical sense such that minor variations in signals either produced by actual minor variation in external events or by the unreliable firing of the nervous system itself can be ignored by the organism. The details of how this system might work and a sub-model for it are presented below. At this point it is only important to note the importance of unselected sensory analyzer input on the informational array and how the amount of unselected analyzer data fluctuates with the central task at hand, decreasing as the informational demands of the central task increase. Thus, for example, under high load tasks such as reading a technical book, the detection of changes within the auditory sphere, already inhibited by the reader, will be reduced even further. Stated more generally, the intersensory capabilities of the organism will be markedly reduced when strict or excessive demands for processing are placed on a single input channel.

Feedback and efference. A second category of information present on the informational array is the feedback produced by the organism's own activity. This feedback includes the kinesthetic sensations from the musculature as well as the auditory feedback from one's own vocalizations. Efference, referring to the organism's registry of his own output commands independent of feedback, is also included here though no unique theoretical significance is ascribed to it.

These data are thought to function in a manner similar to the sensory analyzer data described above. What is most important to consider is that these feedback data are an integral part of the informational array of the functioning organism and hence can enter into the data pattern which constitutes the basis for recognition of objects and events. As the work of Held (Held & Bauer, 1967; Held & Hein, 1963) and others has shown, the importance of the motor system in simple perceptual development is much greater than we initially considered; it is critically important that we introduce these feedback components into the model in such a way that they become an integral part of the organism's cue base. As part of the informational array, feedback from the organism's actions provides the stimulus continuity for directed behavior. In its most basic sense, feedback from a given type of activity may itself be an integral part of the cue base which generates more activities of that same kind. This deduction derives in part from observation of subjects in delayed auditory feedback situations and sensory deprivation situations. In both of these situations the normal input that the organism is used to is significantly disrupted. In the case of delayed auditory feedback, the delayed perception of one's own speech tends to block production of further speech suggesting that the cues of hearing one's own speech or speech production itself are useful in performing further vocal behavior. Similarly, in the sensory deprivation situation some of the subjects report losing directive control, not only of the sensory apparatus which has been denied input but also of the thinking processes. This latter example suggests a greater continuity between thinking and sensory processes than has normally been allowed for in information processing models and is remedied to some extent in the present model by introducing mentation onto the informational array. These examples suggest that the absence of feedback where it is usually present will cause performance decrements, at least until the organism can learn to function under the new cue conditions. The problem the organism faces here is two-fold; first, he is trying to operate in the absence of eliciting cues which this model contends the feedback provides and second, in accord with the signal detection model described below, he naturally will process immediately that information which may explain the absence of the cues usually present. Hence, denying the organism his usual feedback prompts him to examine what has happened to the cue base as well as eliminating a portion of the cue base used to generate further behavior.

Bodily sensations other than the five senses. These data potentially available to the informational array include certain aspects of organ functioning such as heartbeat, respiration and so forth as well as cues from need states such as hunger, thirst and sexual tension. These all may function in combination with mentation (see below) to produce the experiences of emotions and needs as we perceive them phenomenologically. They are listed separately from the senses because their monitoring is not required. Further, though their data can be processed directly, other cues from the senses or mentation can come to signal these need and emotional states as exemplified by Schachter's theory of obesity (1971) making these raw data more expendable. Lacking the demands of consensual validation present in sensory reception, the bodily sensations are more autistic in nature and can in most cases be substantially disregarded by the organism under certain conditions. Their importance, however, for the fully functioning organism, as has been addressed by Carl Rogers and those involved in sensory awareness, prompts insertion of them here in the interest of completeness.

Mentation. The final category of information potentially available on the informational array is broadly called mentation and comprises two broad categories, thought and non-verbal ideation. So little is known about non-verbal ideation that though it may function differently from thought, it is considered under the same heading with thought until we discover enough about it to force its separate listing.

It is not typical to include thought in an information processing model, though it is represented in research to a limited extent under the guise of "induced sets." The cue function of thought is generally acknowledged but is seldom integrated into theory. In the present model, thought as an explicit command or as an implicit directional behavior such as a set is placed in conjunction with other cues as part of the organism's cue base. Whether or not he will follow the directions of thought or those of other aspects of the cue situation or some combination of the two becomes then an empirical question. The reader familiar with Luria's (1961) developmental research on how language comes to direct the behavior of the child will see the obvious implications of inserting thought in this context.

The inclusion of mentation as one of the categories of information that comprise the informational array is a recognition of the phenomenological observation that the same processor which decodes incoming sensory information is also that which calls upon its stored information to be used in thought. Stated more simply, the organism can process external input or it can process material previously stored. This model allows these two to be functionally similar if not entirely identical.

Thought can enter into information processing not only in a fashion parallel to incoming sensory stimulation but can also feed back onto the array in a fashion similar to kinesthetic feedback from the organism's motor behavior. For instance, sensory input can evoke mental activity which can take precedence over the sensory input on the person's informational array. One can recognize this experience when listening to another talk; while at one point listening to the speaker, moments later one finds oneself thinking about what the speaker has said and realizes that the last few seconds of speech were not adequately processed. As a feedback system, thought competes for array space and can function therefore to limit incoming sensory data as well as provide new components to the informational array.

Thought can also be important when it shares the array and becomes part of the neural pattern evoked by other inputs. Thought can hence interact with sensory inputs, input from the need and bodily states, and with kinesthetic feedback. The important role of induced sets in affecting perception is well known as is Schachter's theory of emotion (1965) which posits a similar integration of bodily and thought processes to explain phenomenologically unique states. The present conceptualization further broadens the integrational possibilities and suggests new avenues of research. For example, can perceptual judgements be altered by systematically varying the content of the subject's thought during stimulus presentation?

Array topography. The informational array serves as a central construct for this processing model. It is an integrational mechanism capable of the simultaneous display of a fixed amount of information derived from the four major sources described above. Array size, indicative of the organism's capacity to treat information simultaneously, is likely an important individual difference variable although it is likely overshadowed in importance by the efficiency with which the organism uses the capacity it has. Extremes of mental ability such as those represented by mental retardation may in part be more linked to array size while those characterized as learning disabilities may be more characterized by an inefficient use of an acceptable capacity. In the former case it is interesting to note that the programmatic work of House and Zeamen (1962) has shown quite conclusively that the mentally retarded's central problem concerns an identification of the proper stimulus dimensions relevant to the task at hand rather than to deficient associational processes. Reduced array size results in a sequential handling of the stimulus dimensions where a larger capacity allows for the simultaneous processing of greater amounts of information; hence, it takes the retarded person longer to select the appropriate information.

More typically, information processing by the normal organism involves the efficient use of the limited size array. It can be detrimental to task performance to allow onto the array (1) task-irrelevant sensory information, as for example auditory cues during a reading task, or (2) excessive kinesthetic information not relevant to the task at hand, or (3) information derived from the workings of bodily processes such as one's feeling of hunger or thirst during an education task, or (4) greater amounts of ideational material than are either appropriate for the task or which by virtue of their amount decrease the ability of the organism to process the task-relevant input. The obvious deduction is that the control over the information one allows onto one's informational array constitutes the control issue in information processing efficiency. This gives special prominence to the inhibitory mechanism which serves to impede the flow of information onto the informational array. If the organism is unable to inhibit the information coming either from external sources, from bodily sensations, from thought processes or from its motoric feedback, he comes under the control of events in no way relevant to the task at hand, i.e., "distractors." Gaining control over what constitutes the information on one's informational array would represent the paramount developmental achievement of childhood.

The contents of the informational airay will at all times be heterogeneous with respect to the four cateogries of inputs described above. The important question is not what is being "attended to" but what proportion of the array is devoted to carrying the information from the various possible sources. "Selective attention" in this context concerns the degree of processing of one type of information relative to the processing of others, rather than a qualitative difference in attention. For example, under reading conditions, the task requires that a considerable proportion of the array be given over to visual information particularly that from the various analyzers involved in discriminating form. However, all processing of auditory input has not stopped. Take the following example: if a student is reading a newspaper during a lecture and the professor, noting the student, stops lecturing causing a reduction in the noise level in the room, more than likely this student will perceive the decreased noise and look up to encounter the embarrassing silence. At the same time, other material is being processed as for example the thoughts aroused by the material being read, the peculiar smokey odor of the lecture hall, the kinesthetic feedback registered as muscular discomfort, and so forth. These all will comprise at some point an integrated memory of the event. Two points are worthy of note here; the first is that the distribution of the information array space is flexible, being able to be redistributed from one kind of input to another. The second is that even though an event has a central (task-relevant) focus, many other aspects of the situation have informational value and are coded as a part of the experience. This latter point is discussed further below under a section entitled "Integration."

The issue of the informational array's flexibility, being able to be devoted to any of the types of potential information, is interesting to speculate on. Two possibilities exist, one being that certain portions of the informational array can only carry a certain type of information and if this information is not input a corresponding decrease in the ability of the information processing system would result. The second is that the informational array is totally mutable and can be given over to the representation of inputs from any of the sources. This latter position in the extreme would say that one type of information could totally fill the array where the previous position suggests that certain portions of the array are available only to given inputs and if those inputs are not forthcoming that space is wasted. This issue is of interest when studying processing disabilities; if one is unable to process visual information sufficiently, would one be helped by the reduction of information from other channels as would be suggested if the array is highly flexible?

Sensory Input Signal Life

As information's entrance onto the information array is selective, one must consider what happens to that information not selected. It was his dealings with this and immediately related problems that lead Broadbent to construct his influential information-processing model (1958). Broadbent had noted that two simultaneous streams of information were processed not in the order of their arrival one item from each stream being taken in succession but that the two streams were processed as sets, first one stream and then the other. To account for this phenomenon whereby the order of information retrieval was different from the order of information arrival, Broadbent postulated the existence of an "S" or sensory system which serves to hold the non-preferred stream of information while the preferred stream enters the "p" or processing system. This sensory system also served as a rehearsal mechanism by which the organism could be held for limited periods and then re-entered into the processing system. Though Broadbent's model has now been faulted on a number of grounds, it has not been criticized for ascribing to the same system (s-system) the function of holding both unprocessed sensory input and material from rehearsal. In addition, Broadbent's early model made no mention of a very brief memory which has since been termed as iconic memory within the visual sphere, echoic memory within the auditory sphere (Neisser, 1966).

There are essentially three potentially distinct information handling procedures to be explained here. One is the very brief memory for an event which the organism seeks to process, i.e., he has allowed the material onto his informational array. This type of processing is illustrated by Sperling's (1960) paradigm which presents tachistoscopic visual arrays containing more items than his adult subjects were able to encode totally. Using a partial report procedure, however, Sperling was able to demonstrate that a much greater portion of the information was available to the subject for a brief period following tachistoscopic exposure than would be predicted from the accuracy of the full report. Sperling concluded that there exists a very short-term visual information storage system which held the visual information long enough for the subject to read off the portion of it requested by the experimenter.

A second information processing procedure to be explained is akin to the dichotic listening situation used by Broadbent and the bisensory situation used by the present writer and his colleages (cf., Madsen, Rollins, & Senf, 1970). In these situations two simultaneous streams of information are presented to the subject whose task it is to remember both streams. With rapid presentation rates (two items per channel per second) subjects typically favor and are more accurate when recalling one stream of information followed by the other. This is the initial situation Broadbent discovered and was apparently critical in his thinking as he postulated the existence of the sensory ("s") system. In this situation, different from situation one, the unselected message presumably does not receive any processing but is delayed until the processing of the selected message. Furthermore, unlike situation one, information is presented sequentially to both message channels whereas the initial situation described presents visual information in a single exposure followed by a blank exposure field. Furthermore, the signal life generally shown for the iconic memory situation example is usually figured at less than one second for visual information while accurate recall of three sequentially presented visual items one second apart is able to be accomplished after the recall of the three simultaneously presented auditory signals (Madsen, Rollins, & Senf, VII, 1970).

The third procedure is represented by the classic experiments of Petersen and Petersen (1959) in which they presented trigrams to their subjects followed by variable periods in which the subject was occupied in a counting task to prohibit rehearsal. Report of the trigram following the intervening counting was accomplished with decreasing accuracy to chance level within 15 to 18 seconds. This last case is similar to a rehearsal situation in that the subject encodes the item and then occupies his processing system with some other material and then attempts at a later time to retrieve the initial item.

These three different experimental paradigms have lead to the postulation of different intervening processes. These processes are distinguished by their signal life, the first being extremely brief probably less than one second and termed iconic memory or in Sperling's terms VIS standing for visual information store. In the auditory sphere the signal life is somewhat longer, perhaps up to two seconds and has been termed echoic memory. In the latter case, where a trigram is recalled following an intervening period of irrelevant activity, the signal life as illustrated by accurate report lasts as long as 15 seconds. In the intermediate situation, illustrated by the dichotic listening and bisensory memory paradigms, the accurate report of the message processed second would appear to have a life of up to about four seconds. However, in this middle case, it is possible that the complexity of the information-processing task compels the subject to use the mechanisms of the first and third procedures and as such does not represent a different order of process but rather a combination of two procedures, one which we might term sensory signal life (visually, iconic memory and auditorily, echoic memory) and the second which we might call coded memory in recognition of the fact that in the Petersen and Petersen paradigm and in rehearsal in general the subject has already had the opportunity to code the information into a form appropriate for rehearsal even though rehearsal itself is prohibited. The distinction between coded and uncoded material on the informational array is described below.

The model being proposed here thus deals with these three phenomena in the following manner: the neural activity of the various analyzers stimulated by an external object or event is thought to have a signal life which varies with (1) the specific analyzer, (2) the state of fatigue of the neural transmission system specific to the analyzer data, and (3) the interference from other signals being carried subsequently across the same neural tissue. The Sperling paradigm, in which a brief exposure is presented to the organism who is then post-exposure cued to recall a portion of that information represents a direct test of the signal life of the analyzers involved in transmitting the visual signal to the informational array. That is, the estimates made by Sperling represent, within the context of the present model, the signal life of the analyzer data on the informational array, i.e., a measure of informational array life. Those signals inhibited from entering the informational array or being given such a small area of projection on the informational array so as not to be decodable in very great detail would be expected to have the same signal life as those given much space on the array. Stated attentionally, unattended to and attended to signals have the same signal life. This postulate seems to be the simplest available given the data. The usable life of an uncoded signal comprised of many analyzer firings should be thought of not as having a fixed life but one which can vary somewhat, the iconic memory paradigm used by Sperling being one which maximized the signal life by (1) presenting a large, bright, clearly defined stimulus, (2) following this stimulus with a dark field to eliminate competition for the neural circuitry and (3) allowing time between trials for the receptor and neural system to recover. Under these nearly optimal conditions, signal life is only in the order of a second for the visual system, perhaps somewhat longer for the auditory system. Under more typical viewing conditions, signal life would be expected to be briefer.

Uncoded versus coded array material. The information of the informational array is of two basic kinds, one being non-linguistic raw data from the sensory system and from other bodily functions including kinesthetic feedback from the motoric system. The second type involves a coded representation such as what we term inner speech or thought. As mentioned earlier, there also exists a visual code analygous to our language code which we presently study under the label "imagery."

The notion of a code is very critical here because it allows the organism to translate material which takes a large portion of the uncoded informational array and represents that idea or information in terms of coded neural activity which takes less array space. In this sense a code is efficient. Second, a code is regenerable by the organism. While one is unable to reproduce in an exact, detailed fashion the complexity of a given stimulus input, one is able to reconstruct at a later time one's own "description" of that event. This reconstruction using a verbal or perhaps at times a visual code may in turn stimulate other associated characteristics of the initial experience; the whole recollection is immensely aided by the ability to reproduce a portion of a previous experience using a code.

Language obviously entails these two aspects of a code, efficiency and regenerability. Take, for example, the Petersen and Petersen paradigm whereby a trigram is presented to a subject which he is to recall following an interspersed period of irrelevant activity. All the information contained in the trigram including the size, spacing, width, color or orientation of letters can be reduced to a code representing a consensually defined content of the letters. Furthermore, this code is reproducable such that though the shape, size, orientation and other task-defined irrelevant characteristics of the letters may not be recalled, the shape (names) of the letters can. It is the efficiency of the code and its regenerability together which allow for the phenomenon we know as rehearsal.

The coding process constitutes a shift in information on the array from a neural pattern constituted of rapidly fading analyzer data to a coded representation. Typically, this coding process is of an auditory nature though not necessarily so. Once coded the information has different signal life than that of the analyzer-based signal. As the Petersen and Petersen paradigm demonstrates, once encoded semantically, a signal without further augmentation has a life span of up to 18 seconds.

The more demanding of the organism's capacities the intervening activity between trigram presentation and recall is, the poorer should be the trigram recall. Such a relationship is important in that we are implicitly postulating that this signal life is characteristic of the coded material on the informational array and have not postulated that the coded trigram is shunted off the array into a buffer or "hold" system while the organism undertakes the interpolated task-irrelevant activity. Whether one postulates a hold system or asserts that the coded portion of the informational array maintains the signal has different implications; by hypothesizing that the signal remains on the array, it would be necessary to predict that more demanding interpolated activity, and that interpolated activity similar in content to the signal to-be-recalled, would interfere with correct recall, other predictions also follow. The main point here, though is that signal life on the coded array represents what we know as short-term (STM) memory (for verbal materials which have been coded by the subject). The interface between coded signal life (STM) and long term memory, an important issue in any information processing theory, must be delayed until after describing the flow of information from the information array.

The present model then posits two types of signal life: one is for uncoded (non-linguistic) material arriving from the senses, bodily functions, and kinesthetic feedback. This signal life is relatively short, measured in terms of milliseconds, though it varies with the type of analyzers providing the information, the state of fatigue of the analyzer transmission system, and the amount of information subsequently transmitted by that analyzer transmission system. A second signal life characterizes coded material. A very different set of variables likely influences this signal life, the most important ones being the salience and discriminability of the content of the coded item to the individual. To cite an obvious example, a subject named Bob would have little trouble remembering the trigram "bob" indefinitely. A person not named Bob would certainly remember the trigram "bob" longer than a nonsense trigram though perhaps not as long as the person named Bob. Thus, what I am suggesting here and what will be discussed again later is that the meaning variable studied by psychologists over the last twenty years is conceptualized as affecting the signal life of the coded array material.

The dichotic listening and bisensory memory situations do not readily fit either of these two conceptions of signal life. It is possible that in the dichotic listening situation with three items per channel presented at rapid rates of two items per second, the channel received second may be held as an echoic memory, i.e., according to the signal life of the basic analyzer data, and thus be consistent with the first type of signal life described above.

However, for slower rates and likely for the bisensory situation where the visual modality is involved, it is likely that considerable coding of the signals is occurring during stimulus presentation such that the subject is likely using a combination of coded signals and uncoded ones for the basis of his output.

Integration

Integration refers to two related phenomena, one being the assembling of input from a number of sources into a single experience such that recall or probing of a portion of this total experience may bring forth a remembrance of the remaining portioms of the experience. For example, recalling or being questioned about some event in one's past, as for example a cottage one visited, tends to evoke not only the visual image of the cottage but the surrounding emotions, perhaps even distinctive smells and sounds associated with experiences there. Thus, integration of this sort refers to the coding of many aspects of an event into a common memory.

The second use of the term integration is that cues from different sources can become able to elicit a single recollection. A simple example is how a visually presented graphic symbol is able to elicit the same responses as an auditorily presented one, that is, the same word tends to elicit the same mental activity and the same verbal output. This notion that the equivalence of auditory and visual cuing function of words results from integration suggests a different model of reading acquisition than that commonly assumed whereby the auditory name of the word is thought of as a response item for which the visual graphic symbol is a stimulus item, i.e., paired-associate learning paradigm. To learn the meaning of a new word, i.e., a new visual cue, for which the person already knows the meaning of the corresponding auditory representation of the word, the task as seen as an integrational one would be to associate simultaneously on the informational array both the auditory and visual representations of the word such that the meaning derived from the auditory word could become associated with the visual pattern. This notion will be expanded in the second part of this paper concerned with reading and reading disability.

The basic assumption made here about integration is that the units of information on the informational array have the potential of being integrated by virtue of their simultaneity. Material filling the limited capacity informational array at the same time has the ability to be used as an integral part of the patterns of information coded by the organism. The greater the amount of information involved in the central task undertaken by the person, the less remaining room on the informational array there will be to display cotemporally associated information. Thus, for example, if one chooses to process another's speech, a highly complex signal, little room will remain to display associated aspects of the situation such as one's own bodily sensations, or one's own thoughts, or other input from the senses such as the visual characteristics of the situation. Nevertheless, even in high demand situations such as this, associated information is stored, as for example in remembering a past conversation recalling that it was very hot in the room at the time or recalling a dinner conversation and being able to remember what you each ate.

Span of immediate apprehension. Though the most basic parameter for integration is the simultaneity of items on the informational array, approximate simultaneity may be sufficient. Persons with exceptionally long signal life for either raw data or coded input would be able to integrate events more distant in time and would be said to have longer spans of immediate apprehension. The span of immediate apprehension is increased not only by the longer signal life of the raw and coded material on the informational array but also by coding and rehearsal strategies adopted by the subject. Signal life is enhanced through coding, as coded material has a life measured in seconds while uncoded material fades in milliseconds. Also, because coded information on the array has the characteristic of being regenerable, the person is able to reinstate on the array certain coded aspects of experience for indefinite periods of time, thus increasing the likelihood that it will be integrated with other materials on the array. Use of the rehearsal mechanism to regenerate portions of one's experience in coded fashion likely accounts for a greater portion of the variability in the span of immediate apprehension than does the longer signal life some people may possess. A rehearsal strategy can readily double an event's active life with only a single repetition which represents a larger difference in signal life than likely would be the difference between the signal life of two individuals.

Capacity for integration. Man does not possess any extraordinary sensory capabilities but rather derives his superior knowledge of his environment through an ability to gather together information from a variety of sources and unite it into a single memory. This ability has been termed "intersensory integration" (Birch & Lefford, 1963). In the context of the present model, integration is related to three factors, one being the array size which places limits on the organism's ability to register information simultaneously, the second being the information load of the material on the array, and the third being coding and rehearsal strategies which extend the life of information and, hence, allow its integration with a greater amount and wider variety of other information.

Typically, information streams onto the informational array simultaneously, the person defining the central channel in such a way that all of the information to be integrated is allowed onto the array. An example would be the experience of a bouquet of flowers with aspects of color, shape, texture, odor, and flower names all finding room for simultaneous processing. Hence, the person experiences the bouquet as an integral object not as a fragmented series of colors, shapes, textures, smells, and labels. Though this point seems terribly obvious, one must recognize that it is possible to experience the bouquet differently, for example, by selectively processing the curvature of one of the blossoms. Such detailed processing of one aspect of the situation could tend to utilize so much of the array size (capacity) that the observer could fail to note the colors utilized in the whole bouquet, of the bouquet's odor, and so forth. Thus, this example illustrates that integration requires a processing strategy which defines the channel broadly enough to allow the information to be entered onto the array simultaneously. The greater one's array size, the more information-laden can be the material simultaneously represented for integration.

The more demanding the central processing task set by the organism becomes, as for example decoding spoken or written speech, or undertaking a complex nonsemantic task such as crossing a busy intersection, the less array space there will remain for the simultaneous registry of input from other sources. Consequently, the stored representation of the total event becomes less dimensional, possessing components from fewer sources. One notes, for example, how conversations stop or at least become fragmented when one crosses a heavily trafficked street. Such occurrences result from the subject's inability to process in sufficient detail the complex analyzer data telling him about the distance and speed of moving automobiles at the same time as the linguistic input or output. It should be able to be shown in an experimental context that integration will decrease as a function increased information demands of the central task.

What can be integrated? The informational array allows for the simultaneous consideration of a huge variety of information. The unique combinations of information possible are virtually unlimited. Even the simple reception of a seven digit number, for example, will process differently depending upon whether part of the informational array contains the thought that it is a telephone number or a sum of money. The first case will likely cause the person to group the numbers in a series of three digits followed by a series of four digits while the latter case will result in a different grouping, the exact grouping depending on whether whole dollars or cents are involved. It is to a large extent an empirical question whether information from the four different sources noted in the section on the informational array content above can be combined to form new products. By illustration, consider first the simplest case of looking for combinations of patterns within the sensory input system alone. The easiest way to approach this question is to ask how does an external object come to be known by the organism? According to the present model it is the simultaneous display, i.e., integration, of the sensory input from the object on the informational array that provides us with a total idea or memory of an object. A brick has a certain size, shape, color, texture, and is even construed to have a certain sound were it to be dropped on a hard surface. A violation of any one of these expectations about the brick would immediately be noticed because the total pattern on the informational array would be altered to that extent. Plastic flowers lacking odor or a known food cooked by another to a different texture than one is used to is immediately noticed as different from one's own conception of the object. The present model contends that it is not through a sequential checking of the object's properties that one notices these differences but that the total experience as defined by a pattern of informational firing on the informational array deviates in some significant way from a pattern previously established. Similarly, need states become an integral part of an experience and influence the total conception of an event as has been well documented by the experimental study of the effect of various deprivation states on the judgment of foods and other desired objects such as the experiments on the size judgment of coins by rich and poor children.

The interesting question which needs to be subjected to empirical test is whether thoughts can function in the same manner as need states, thus influencing the total analysis of an event by becoming a part of the stimulus complex used in registering the event. A recent experience makes me think that thoughts are able to function in this manner. Sitting across a swimming pool from a large box-like structure, I noticed what I thought were people looking at a rectangular board projecting almost vertically from this box-like base. From the way they were staring at the side of the board facing away from my view, I presumed it to be a sign, likely containing rules governing use of the pool. A few minutes later, however, a maintenance man came up to the box-like structure and looked down into it; immediately, it occurred to me that the rectangular piece of wood atop the box was not a sign at all but rather was the top of the box propped open for easy access to the materials inside. These two entirely different interpretations of this distant object, I think, can be explained in terms of the different associated thoughts evoked by the actions of the different people involved in the two situations. In the first case the vertical, rectangular wooden board was seen as a sign by virtue of persons on the other side appearing to be staring at it while the second time in conjunction with the workman, it appeared as a top of the box into which he was looking. Though trivial, in and of itself, this example suggests a link between our study of thinking and our study of perception. The basic issue here is how the presence of specific thoughts affects the interpretation of sensory input. Perception as a personal experience modified by the individual's history may be mediated by his ever-present thought processes which can interact with sensory input to modify his resulting mental and behavioral activity. Desirability of a new food, for example, may be continuously rated low and actually disliked by a person possessing the cognition that new foods are in general undesirable. As Rogers has pointed out in his personality theory (1959), the evaluation of the experiences by an individual may be more heavily determined by his cognition about what other people think of the event than by the analysis of the perceptual and bodily sensations the experience produces in himself. Both of these examples suggest the possibility that thought can affect our perceptions and subsequent behavior. This theoretical conception which places both sensory data and thought onto the informational array suggests new experimental questions which deserve study.

Perceptual sets. The relationship between thoughts and perception as discussed in the immediately preceding section has received some study under the name "perceptual sets." Essentially a set is an internally generated readiness to receive a certain specific content of information or to code or arrange specific information in a certain manner, that is, to "see" a certain relationship between events. The very nature of a set requires that it be mediated verbally and hence is uniquely human. For an organism to be primed to receive a certain signal it must be able to conceptualize that signal prior to its presentation. Similarly to the basic assumption of the Information-Integration theory that our experience of attention results from the act of processing itself, our experience of a readiness to receive information, is assumed to result from information processing as well. Such processing could be the priming or pre-firing of a certain subset of cells which are going to be necessary to carry the expected information. As such, the experience of a set would constitute the transmission of information from the storage areas to the coded portions of the informational array.

The experience of a set or the readiness disappears when the information arrives. Such an effect could result from the coded array which carries the internally generated readiness being also used for the actual reception of the event. It is for this reason that the experience of being ready to receive information is unable to co-exist with the actual experience of processing the information itself. One cannot both experience being set to receive information and actually receive it at the same time.

The basic issue for the present theory is whether the notion of sets requires mechanisms in addition to those used in actual information selection. Recall that information selection involves the inhibitory mechanism through which channel formation operates. While a set would be thought to initiate the same inhibitory process necessary for the registry of the material expected, an additional process is involved, already alluded to in the preceding paragraph. This is that the set produces on the coded portion of the informational array a representation of the event sought after. This representation on the coded portion of the informational array is an adequate stimulus for establishing an appropriate inhibitory pattern which will maximize the reception of the event in question. Furthermore, whereas the coded array already carries a representation of the events looked for, translation from the raw stimulus input when received to the coded portion of the stimulus array is made more efficient by virtue of their previous coded neural activity. Thus, sets aid reception in as many as three ways: first, they serve an alerting function allowing the subject time to increase his activation level as for example through increased muscular tonis. Second, the increase in the activation level can aid in the establishment of an appropriate channel if fore-knowledge of the expected signals is sufficiently specific. Third, by already having the expected information activated on the coded portion of the informational array, the translation of the raw input to the coded array is facilitated. These three functions should be able to be experimentally separated perhaps in a fashion akin to the recent series of studies by Posner and Boise (1971).

THE FLOW OF INFORMATION

Description of the model to this point has concerned itself solely with the constructs and their functions that define the theory. Only occasional mention has been made of how information moves through this information processing model. A flow of information through the model has not been stressed because the model is more concerned with how information is organized and how the organism uses this information to generate behavior. This focus stresses that information processing is more than a transduction of energy from an environmental event registered by the organism but rather represents a total adaptive response of the organism by which it continually maintains contact with its environment, using the information from the environment and from its own behavior continually to update its relationship with the outer world.

Information does not flow through the information-processing system as much as it is organized by it. Information flows to the informational array from a variety of directions. These include the transduction of information at the senses where the specific analyzers transmit information about unit aspects of the environment toward the informational array. The usable signal life of these various impulses output is a function of the strength of the initial input, the number of analyzers transmitting the information, the state of receptivity of the analyzers and the amount of subsequent transmission of information over the same analyzers.

In addition to sensory data, information from feedback and efference, and from the other bodily processes such as heart rate and respiration, also project onto the uncoded portion of the informational array. Information of this variety gains access to the information array by virtue of it being constituted as the channel of information to be received by the organism. Much of this information potentially available to the organism does not register on the array. However, more than that normally conceived to be the central signal, as for example a trigram in a memory experiment, is received by the organism; up to its level of processing capacity, information enters the informational array in parallel. Thus, even though the organism may be dealing with highly information-laden semanic material, other aspects of the external situation such as features within the room, particularly irrelevant dimensions of the stimulus materials themselves, and so forth may become part of the effective simulus situation for the person.

In addition to uncoded array input, material approaches the informational array from the subject's memory. This material is coded by the organism in terms of an idiosyncratic code, likely heavily verbal in nature though the model does not rule out the possibility of other types of coding, for example visual imagery. The coded material differs from the raw input on the uncoded array in that (1) as coded material it represents an efficient subset of the raw material and (2) it is regenerable in the sense that the organism can produce upon its coded information array that pattern of information.

The information simultaneously present on the informational array is capable of being read as a total pattern such that materials from various senses as well as material from bodily sensations other than the senses and in addition material from thought processes can be simultaneously available to the subject. In this manner, the response to the information on the visual array can be heavily influenced by the thought or other bodily processes of the organism. The organism's capacity to form channels which allow the simultaneous display of information from these various sources is likely heavily correlated with the organism's creativity. Unique combinations of events simultaneously present on the array are unlimited and are further enhanced by the subjects with extremely long signal life and more importantly by the use of rehearsal strategies which regenerate coded material to make it available as part of the informational array for longer periods of time. The size of the array, i.e., the information-processing capacity, the subject's ability to construct channels which cut across the various informational input modes and his rehearsal strategies all will affect the amount of integration he achieves. This integration allows for memories to contain elements from many sources such that the presentation of a portion of the event can evoke memory of the entire event, thus providing the organism with extreme powers of recollection, having so many access routes to the various events he has stored.

Information of the uncoded array, just as that not permitted entrance onto the array, has a very short signal life, measured in terms of a second (plus or minus). Uncoded input can be maintained by applying a code to it thereby approximating its representation on the coded array. The uncoded event is only approximated by the coded representation, there being a loss in detail, in particular those details that the culture's language does not deem important. Though the coded representation loses information, integrational power is derived from its efficiency, longer signal life, and regenerability.

However, all uncoded information is certainly not first represented on the coded array prior to its evoking further neural activity in the form of thoughts and images. More typically one's neural activity, whether "mental" or motoric, flows directly from the uncoded input just as it does in the case of non-verbal infrahuman organisms which presumably do not possess the capabilities associated with the coded portion of the informational array.

Semantic information on the uncoded portion of the informational array (e.g., visual graphemes) may be special in this regard. Frequently, a person appears to translate linguistic raw input into coded form prior to its evoking some further neural activity in the organism such as thoughts and images.

However, some visually presented semantic material on the uncoded portion of the informational array may give rise directly to further neural activity without first being translated into the linguistic code. There is no *a priori* reason why the graphic forms cannot generate images just as the form of an actual object does; both require the same integration process to embue the form data with meaning, i.e., with derivative mental activity. In fact it has recently been shown that visual graphemes can be recalled without the benefit of the linguistic decoding process (Parkinson, 1972).

Information thus can enter the coded portion of the informational array by translation from the uncoded portion, as for example by reading a sentence or naming an object, from the subject's own memory, as for example by some recollection, thought or self-direction, on from the coded array itself through the regenerative process of rehearsal.

While the information array size (capacity) is limited, the boundaries between input from the various sources remain flexible. While it is unlikely the case that the total array can be given over to any small select portion of the available input information, the degree to which this is possible is a measure of the organism's capacity for detailed examination of an input. Within the Information-Integration theory, this selective ability is postulated to relate to the reticular activating system's ability to provide the inhibitory energy necessary for channel formation. The ability to divide one's informational array between input from a variety of sources, which also likely requires considerable inhibitory skill, is an indicant of the organism's integrational ability, of the ability to experience an object or event in a variety of ways and hence provide a more complex memory of that event which in turn allows for easier retrieval of that memory. Also, the uniqueness with which the person can construct channels from a variety of sources allows for the creative synthesis of material stored in memory brought onto the array through thoughts and input from the external world brought to the uncoded portion of the array by the sensory analyzers.

Post Array Information Flow

Not only must information be decoded but to have it understood it must be integrated with material already in memory. This relational process to stored material is critical to thinking. For example, a novel like *Gone With the Wind* is substantially different to an early adolescent than to one with broader experience, as is the case for any novel. Clearly there must be some liason between the semantic decoding of the signal as exists on the coded portion of the informational array and the use of the organism can make of this information.

An active process is implicated by which the information pattern on the coded portion of the informational array acts as a proximal stimulus for further neural activity. This active process is critically important as it is this process which maintains one's interest in the array material and hence governs heavily what portion of the information available will be selected in the immediate and distant future.

Given that there is obviously more to information processing than the literal decoding of graphic symbols or other aspects of one's environment, one can speculate as to why one person's interest (that is one's processing) is maintained for a given material while another individual's attention wanders when presented with the same material. Similarly, certain stimulus presentations are more interesting for almost all persons than are others; what are the characteristics of these more interesting presentations such that they are able to demand access to the informational array? To cite some examples, why is a moving picture more interesting or at least continues to be processed for longer periods than still slides? Or why are color slides more interesting than black and white ones on the whole?

Viewing as this theory does, that attention is really a reflection of the presence of ongoing information processing, an answer seems readily available: this would be that interest (or attention) will wax and wane with the organism's ability to act on, i.e., to process and be stimulated by the information. The common expression "being put to sleep" as an expression of boredom is very apt in this regard. A person loses his attention and interest, becomes bored, and his "attention wanders" when the material striking his sense receptors, though able to be decoded, does not further excite the organism. Thus, it would appear that the mechanism responsible for determining what we process (attend to) is located subsequent to the informational array. Array material will be sought after in kind if it stimulates further neural activity, either "mental" or motoric but will be replaced by other information if it is not so stimulating. For example, one will discontinue reading when the physical feature analysis fails to stimulate further neural activity (thinking and nonverbal ideation-imagery). If one is compelled to continue reading, as for example by a class assignment, one experiences boredom and is continually distracted by intrusive thoughts or extraneous external stimuli. Though the physical features of the graphic symbols continue to be brought to the informational array, their failure to excite further neural activity initiates a shutoff process which will eventually terminate the selection of visual information despite the desperate self-instruction to "concentrate" being repeatedly represented on the coded array.

A second example illustrates another point. In looking at black and white stills the observer's color analyzers are essentially dormant as are the myriad of receptors sensitive to movement, as the information available in a still picture has to do with the form, contours, and shadings. These data may not be sufficient to fill the informational array, especially if the pictures do not excite thinking which will feed back onto the array. Failure to occupy the array, whether caused indirectly by ceasing to input information, which is not further stimulating, or directly by a barren stimulus environment, will result in the organism selecting input from other available sources. Frequently, these other sources provide task-irrelevant information and are hence, referred to as "distractors." However, the processing of these distractor data represents less the interruption of the processing system than it does the lawful functioning of a system which has been provided with a central task insufficient to maintain continued processing. This assertion is formalized in a major theoretical postulate concerning the motivational aspects of information processing and a model for the selection of information outlined below.

Progenerative Hypotheses: A Reinforcement Mechanism

If the organism is not capable of making discriminant responses to the informational array, the information will quickly become boring to him. For example, the person who has a great deal of experience with line drawings can make finer discriminations and hence maintain his interest by keeping his processing array operating. How long, for example could a naive observer study x-rays even though the initial one or two may look fascinating. The rather obvious answer is that in being unable to discriminate the relevant cues, all x-ray patterns look very much alike and hence in a very basic sense do not have informational value for the novice.

Such a notion of interest-value, being based on the organism's ability to discriminate the input on his array, implies that it is the likelihood that information falling on the informational array will stimulate further neural activity which determines what information the array will select in the future. It is not the physical aspects of the processing task which support a person's interest, neither is it the content of the information per se that interests someone but rather it is what the content stimulates in the person. Within the context of the Information-Integration model, continued processing of a given source will be of a higher probability if that information stimulates further neural activity. If little neural activity flows from the array, then the array information has correspondingly little signal value for that organism. Consequently, in such instances when the organism is not further stimulated, one experiences one's attention as wandering, indicative of the fact that further information extraction is not occurring. The implications of the failure of the array information to stimulate imagery and thought will be discussed in the second major section of this paper dealing with specific learning disabilities in reading.

Information flow from the informational array. Theoretically, it would be possible for the organism to entertain information on the uncoded and/or coded portions of his informational array and have not later recollection of them. If the pattern of firing which in the informational array activates no further neural activity, then there will be no memory for the event after its signal life on the informational array has expired. It is likely that this extreme case seldom occurs, but may be approached in conditions of information processing pathology. More typically, almost any input has some meaning to the individual such that it is capable of evoking a network of neural activity. The character of this network activity has likely been approximated operationally by psychologists in their study of the associational matrix of semantic material and in terms of the concept of "meaning" as it is defined by associations.

Information on the coded array most closely corresponds to the term "short term memory" while any activation of stored material by the informational array could be described as "long term memory." The distinction between short and long term memory is that the coded signal and the span of immediate apprehension, augmented at times by rehearsal, roughly corresponds to STM while evidence for LTM requires that the neural activity corresponding to the event have ceased its representation on the informational array prior to its being recalled.

The material on the informational array gives rise to further neural activity. One can conceive of the process in s-r terms, the array pattern representing a unique proximal stimulus and the post-array neural activity the response. In highly practiced situations and in a very defined stimulus environments, very discrete and consistent mental or motoric activity will follow. It is likely that this extreme case seldom occurs, but may be approached in conditions of information processing pathology. More typically, almost any input has some meaning to the individual such that it is capable of evoking a network of neural activity. The character of this network of activity has likely been approximated operationally by psychologists in their study of the associated matrix of semantic material and in terms of the concept of "meaning" as it is defined by associations. In more loosely controlled situations, the neural activity aroused by the pattern of neural events on the informational array will be less predictable. In the extreme case where a totally novel situation is encountered, the post-array neural activity will be highly variable. Situation here is not the external environment but the proximal situation represented by the informational array. Totally novel situations can derive from array data drawn from a number of sources, e.g., thought and sensation. Creativity may relate to the person's ability to entertain diverse information simultaneously on his informational array.

The post-array neural activity consisting of imagery and thought (imaginal system) and efferent firing has access to the coded portion of the information array and is continually monitored in a fashion analogous to the continual registry of sensory input. Thus, the pattern of firing on the informational array gives rise to imaginal and/or efferent activity both of which feed back onto the informational array to provide the cue base for further post array neural activity. Consequently, continuity of the organism's behavior is enhanced by feedback from both the imaginal system and kinesthecic sources as well as by the continuity of stimulation from the organism's internal and external environment. Thus, just as in the case of kinesthetic feedback where the motor system set in motion by the total pattern on the informational array provides feedback from which further behavior is generated.

Aside from the feedback function, it must be stressed in closing this section that the stimulation of the imaginal system represents a motivationally satisfying state for the organism. Material which stimulates the imaginal system will be sought after and brought to the informational array. The basic motivational premise here is that the stimulation of cell B by cell A will continue if B is able to stimulate some further cell C. If, however, cell B is unable to stimulate cell C the likelihood of A stimulating B will be decreased. Said within the constructs of this theory, if the informational array data (B) is unable to stimulate the imaginal system (C), then the likelihood that the informational array (B) will continue to receive information from those analyzers (A) will be reduced. Conversely, stimulation of the imaginal system (C) by the informational array (B) increases the probability that the analyzer data (A) will continue to enter the array (B).

THE SELECTION OF INFORMATION

A critical issue not ordinarily dealt with by information processing models derives more from attentional constructs than from strictly informational ones. This is the issue of what gets processed, said attentionally, what does the organism attend to? Most of the information processing research has been concerned more with the operating capabilities of the human system and less with its actual operating characteristics. A particularly interesting and important question when considering the information processing characteristics of deviant samples concerns why the organism devotes its resources to the processing of some information to the exclusion of other.

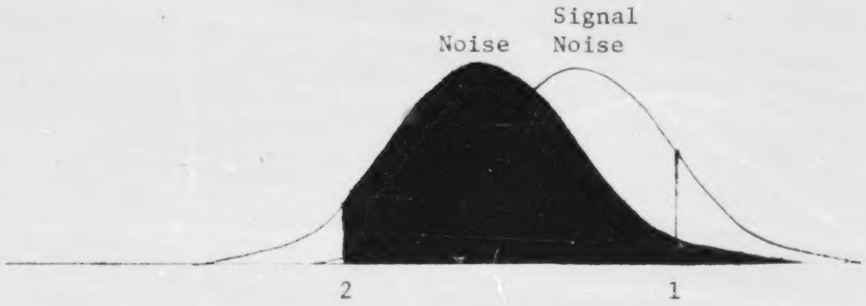
Signal Detection Model

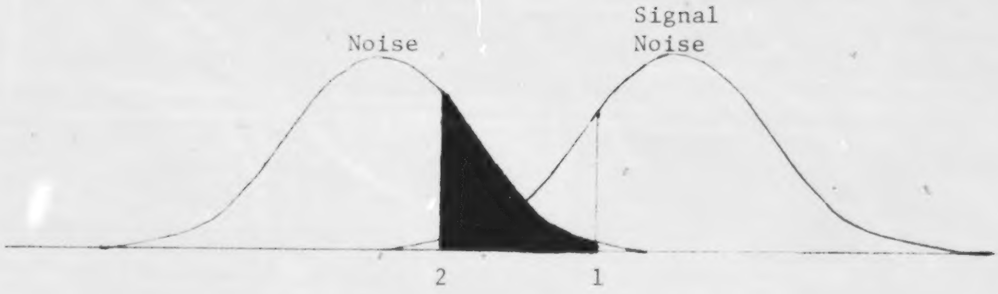
The most basic principle operating to sustain processing has been discussed in the section immediately above; information will be selected for analysis if it is capable of stimulating further neural activity. This postulate implicitly states that information is intrinsically rewarding and is therefore sought after. Information falling on the informational array from the analyzers will be continually sought to the degree that it stimulates post-information-array activity.

A second factor operating contrary to the first is satiation. Continued excitation of the same meural fibers results in receptor and neural cell fatigue. The experience of boredom derives from a failure of the informational array to produce further imaginal activity either because of satiation or for some other set of reasons which limit the flow of imaginal activity from the informational array.

The progenerative principle whereby the organism seeks further information of the kind it found stimulating and the satiation principle whereby continued stimulation by identical or similar sources tends to be discontinued can be thought to operate in the context of a modified signal detection model. Signal detection theory as applied to the most basic psychophysical situation involves conceptualizing the background cues as noise above which the stimulus is to be received. The stimulus, termed the signal, is thought to have a distribution of subjective strength which must be on the average higher than that of the background stimulation, termed noise, if it is to be received reliably. As shown in the accompanying figure, the distribution of the background noise and that of the signal's strength can be depicted as overlapping normal curves. The distribution of the signal shown to extend further to the right than does the distribution of noise indicates its greater signal intensity. The subject experiencing the situation is required to determine whether a signal has been present or whether it has been absent. To accomplish this task the subject is thought to establish a subjective criterion by which he decides whether or not to acknowledge the presence of a signal. This decision criterion has been shown to be generally independent of the sensitivity of the subject, sensitivity being a measure of his organismic ability to discriminate the signal from the background noise. Thus, with his decision criterion set at position one in the accompanying figure, the subject will never mistake background noise for signal but will frequently fail to recognize the presence of a signal when it is actually there. This is to say in the language of signal detection theory that the subject will make no false alarms but will make a large number of misses. With his criterion for decision set at point two, the subject will make fewer misses, recognizing the presence of the signal more often when it occurs than by setting his decision criterion at point one. However, he will also make more false alarms as shown by the shaded portion of the noise distribution lying to the right of his decision criterion, stating that the signal was present when in reality only noise was present.

Not only does the subject's decision criterion affect the accuracy of his judgments but so also does the actual organismic sensitivity. The organismic sensitivity and the actual physical difference between the signal and the background noise can be conceptualized as creating a larger distance between the noise and the signal distributions shown in the second frame of the accompanying figure. Setting his decision criterion at point 1A so as not


Signal
Noise
Noise
2
1


Signal
Noise
Noise
2
1

to make any false alarms, the subject with greater sensitivity or a subject operating under conditions where the signal is of much greater intensity than the surrounding noise is able to make correct recognitions (hits) on a greater proportion of the signals than in the previous example. Adopting the decision criterion at point 2A, the subject assures himself that he will make almost no misses but in so doing allows for a number of false alarms given by the shaded portion of the noise distribution. However, it is the greater discriminability of the noise from the signal distribution in the second example that allows the subject to achieve a near hundred percent hit rate while allowing only a few false alarms. In the first example, the subject setting his decision criterion at point two to achieve a near perfect hit rate also allows a huge number of false alarms.

This distance between the two distributions of signal and noise is an index of the discriminability of the signal from the noise and has been labeled d' (d prime) within the context of signal detection theory. In the typical psychophysical experiment, the noise distribution is constituted of the background stimuli in the testing session and the subject's internal variability, for example his thinking about something outside of the experiment. Noise is kept to a minimum by informing the subject prior to each time period during which the signal might be presented; the signal is frequently of a barely discernible amplitude. This signal detection model can be applied to a very different type of reception situation by conceptualizing the noise distribution as the material on the informational array of the subject, and the signal distribution as that stimulus or informational unit which potentially may be entered onto the array. Essentially this involves no conceptual extrapolation, the only difference being that in the standard psychophysical situation care is taken to reduce to a minimum the noise distribution (array content) where in the more typical operating situation, the human is typically involved in the active analysis of information other than potential signals. The critical issue then becomes, what are the conditions under which a signal not presently on the array will be selected for array representation? Said more completely within the constructs of the Information-Integration Theory, what are the conditions under which information will either gain access to the informational array or increase its percentage occupancy of the informational array at the expense of information already on the informational array?

The signal detection analysis allows us to expect that under conditions where (1) d' is increased, that is the discriminability between information presently on the informational array and the signal in question is increased or when (2) the decision criterion is lowered, a signal will command increased space on the informational array. Let us consider first the conditions under which changes in the d' will affect the selection of information for the array.

Changes in d'. The d' can be increased either by strengthening the signal or by reducing the noise. The first implies that strong, intense stimuli will have a greater likelihood of gaining access to the informational array than will weaker stimuli, holding constant the contents of the array itself. In the case of loud noises or bright visual stimuli or intense tactual stimuli and the like, this deduction makes intuitive sense. However, the same would be predicted by the theory to hold true for other inputs to the informational array which include feedback from the bodily motor activity, other bodily cues such as respiration, heart rate, as well as thoughts.

The measurement problems here cannot be denied for it is clearly easier to test the prediction that strong sensory stimuli will have a greater likelihood of gaining access to the informational array than weaker sensory stimuli than it is to test the prediction that strong thoughts will have a greater likelihood of penetrating the informational array than will weaker thoughts. The rather obvious problem here is that we lack measurement units for the intensity of these internal events which can be approximated in the case of sensory input by measurement of the physical characteristics of the stimuli applied. Information about bodily states such as hunger or thirst or heart rate have the same measurement problems as thoughts. These examples while also unable to be measured in physical units in the manner possible with sensory stimuli have been rather successfully investigated in the context of other theoretical models (S-R models, for example) by appeal to construct validation. Thus, for example, hunger cues are assumed to increase as the number of hours from eating increases, as a function of the amount of food provided the organism, and so forth. One would hope that the issue of whether thoughts act in the manner suggested by the present theory could be assessed through a similar methodology.

The d' can also be increased by a decrease in strength of the data of the array, the "noise" component with which incoming information is competing. The extreme condition here or nearly approximate to it is the traditional psychophysical experiment where reception of some signal is maximized by minimizing other sensory input and preparing the subject in a comfortable surrounding and informing him of the period during which the signal should arrive in order that he might best prepare himself. Within the constructs of the present theory, this situation is seen as clearing the informational array as much as possible and providing the subject with a set to expect a certain kind of information. Clearing one's informational array in preparation for reception of some future information increases the relative distance between the signal and "noise" (the array content). In addition to reducing the informational array content, the readiness set has two additional functions: one is that given sufficiently specific information as to the nature of the incoming signal, the inhibitory process can actively block input from unwanted sources, and second, the activation of the expected signal on the coded portion of the informational array can facilitate recognition of the raw signal pattern on the uncoded portion of the array. Most critical here though is the notion that the relative absence of material on the informational array increases the likelihood that a potential signal will gain access to the array.

This extreme case where the informational array is cleared maximally constitutes one point on a dimension. This dimension is defined by the degree to which the informational array is filled with data. When undertaking a task which is experienced as interesting and absorbing, the informational array will continue to gather information specifically relevant to the task at hand. This is in line with the progenerative hypothesis that an informational array which elicits further neural activity will continue to be supplied with information to further that activity, i.e., it will continue to select information from the same sources. If, however, the information on the array does not give rise to further neural activity, the organism will be less likely to seek continued information from those sources which will result in the informational array being inadequately filled. This state will be remedied by information coming from other sources, that is other signals will be received. Thus, in the case of simple tasks and in the case of boring tasks, the information array has extra capacity and thus allows for "distractor stimuli" to gain access to the array. It is for this reason that tasks not perceived to be interesting tend to allow for a great deal of distraction.

A third manner in which d' can be affected and hence change the character of the information which gains access to the array concerns the inhibition process. Recall that reception of any channel of information is made possible by the relative inhibition of other aspects of the organism's environment including the environment constituted of his own feedback and mental activity. Inhibition is the process by which analyzer data are prohibited entry to the informational array. In practice this process is relative; for example, as has been discussed above, in the dichotic listening situation, the processing of information in one channel prohibits the semantic decoding of the information in the other but does not totally obscure the reception of the "unattended to" channel. Rather, very basic information such as the pitch of the unattended to message is registered. In the context of the Information-Integration Theory, it was argued that the array was not large enough to carry the information from both channels but was large enough to carry basic information about the physical characteristics of the "unattended to" signal. Thus, though inhibition is not necessarily capable of eliminating entirely a potential signal from the informational array, the use of inhibition against a certain set of analyzers does have the function of decreasing d' and hence the likelihood that the inhibited signal will gain more space on the array. In decreasing d', inhibition makes the potential signal or even the amount of the given signal already being received less distinguishable from the array content, thus decreasing the likelihood that that signal source will be processed in the immediate future.

In general, the larger d' becomes the more likely it is that the signal will increase its representation on the information array. Inasmuch as cues are not processed as units of analyzer firing but are constituted into channels, it is likely that the signal with a large enough d' to be received initially commands a major portion of the informational array in a rather undifferentiated manner and immediately following, within milliseconds, is constituted into a channel. If the signal source, once constituted into a channel, does not have signal value for the organism, that is if it does not stimulate further neural activity, processing of the source will be discontinued in favor of new input.

Change in decision criteria. Changes in the specific content of information processed at any moment (changes in attention deployment) are also dependent upon the decision criteria the subject imposes on incoming signals. Even though a certain type of information may normally be allotted some small proportion of the array, as for example is our kinesthetic information alloted sufficient space for coordinated motor activity, the decision criterion specifies the degree of signal uniqueness sufficient to cause the organism to form a central channel around that signal. Signals of an intensity falling below the decision criterion will not cause the organism to form a channel around the signal. Rather, the information in that signal will continue to be utilized in a manner as before unless some other signal source demands some portion of the informational array carrying the initial signal in question. Then, the initial signal source can lose part of its even small representation on the array. For example, some small change in the ambient sound level of the room will not be sufficient (will fall below the decision criterion) for the organism to form a channel to process the sound source further even though the ambient sound level is being registered. Further, if a particularly striking thought, body sensation, or other sensory input occurs, it may require that the organism retract some of the small amount of array space allocated to the sensing of the ambient sound level in the room in order to register adequately the central information.

If a signal is of greater intensity than the criterion, a channel will be formed surrounding that signal and it will command considerable space on the informational array. As this change in array content is taking place, d' for other signal sources is greatly reduced, making the organism very insensitive to new input of any kind. Once the channel has been constituted, the d' for other signal sources will be re-established according to the parameters discussed above. In addition, the new processing situation may bring about changes in the decision criteria assigned to the reception of new input from the various signal sources.

The rules governing decision criteria are extremely important for any theory which seeks to explain the sequence of information processing (attention deployment). At any point in time depending on the array content, the behaving organism adjusts the decision criteria for reception of information from the various analyzer and analyzer combinations. For example, decision criteria can be adjusted up so that increased signal strength will not be sufficient to require the organism to form a central channel around the input source. Take a specific example such as sitting down. Increased processing of visual, tactile, and kinesthetic information is required; but one need not form a central channel around these sources to execute this simple behavior. Instead, one can raise decision criteria for these sources and simply give over more of the array to them which will occur automatically as the organism begins to sit as long as he does not try to inhibit these data. As he sits, the person can continue his conversation or other ongoing activity though it may proceed haltingly as the informational demands from the visual, tactile, and kinesthetic sources usurp greater amounts of the array space. If, even after raising the decision criteria for visual, tactile, and kinesthetic sources, a signal is registered which deviates sufficiently from the immediately previous array data that it falls above the criterion, then a channel will be formed around the source and the ongoing activity such as the conversation will be replaced. Such could occur if one notices an object on the chair, brushes against the arm of the chair, finds the chair harder or softer than allowed by the tactile decision criterion, and so forth.

The central point is that the organism sets as a function of the information on the array decision criteria for the reception of information for various analyzer combinations. As long as the stimulation falls below these criteria, it is processed in the amount allowed by the workings of the inhibition system which selects and defines the channel being processed. Information falling above the decision criterion requires the organism to reconstitute its central channel surrounding the stimulation in question.

Processing of any material will thus continue with the channel as constituted until either (a) a signal sufficiently different from that being processed which is above the decision criterion set by the organism is received; (b) a signal source insufficiently inhibited transmits data which though below criterion are sufficiently information-laden to upset the ongoing channel by leaving it with insufficient array space to represent its data. The person in these cases will experience losing his "train of thought" without some other signal source "taking over"; (c) the neural activity stimulated by the informational array declines in frequency to the point where further information-gathering from the source supplying the array is discontinued; (d) satiation occurs; in both (c) and (d), the reduction of array information directly increases d' and lowers decision criteria thereby increasing the probability that some new signal will be of sufficient relative strength to gain representation on the array; (e) some subset of the information in the central channel is sufficiently deviant to provoke a more defined channel involving that informational set. This is a special case of (a) where the signal source for the new channel exists within rather than outside of the original channel; (f) a (learned) thought is evoked which instructs the organism to alter its processing. Self-instruction thoughts such as "what was I doing?" or "pay attention!" or "concentrate!" are conceived of as feedback from mentation onto the coded array. These thoughts have typically low decision criteria, thus allowing their frequent use in constituting new channels. They are aroused in somewhat different situations for different people depending on one's training but in general when the central-channel information is not relevant to the idea represented on the coded array about the task at hand. By maintaining ("keeping in mind") a notion of one's task, one can learn to respond with self-admonishment whenever the central channel content evokes post-array activity more discrepant than a set criterion than that deemed relevant to the task. The role of the coded array in directing information processing is considered immediately below.

Special role of the coded array in direction information processing. The coded portion of the informational array plays an important role in maintaining what is called "directed attention" i.e., processing of a given channel once constituted. By virtue of its relatively great stability, the coded portion of the informational array is first able to assure that the array will have content in it and, hence, not be vulnerable to outside "distraction." Recall that the more usurped the array is, the smaller will be the d' between extraneous signals and the array content. Consequently, extraneous signals would have a lower likelihood of gaining entrance to the array. Second, for the same reasons, the rehearsal capability of the coded array provides further stability. Third, the coded array can represent verbal instructions and self-induced sets which direct the coding of information received by the uncoded portions of the array, thereby increasing its signal life. This coding and the subsequent imaginal and motor activity resulting from it facilitates the maintenance of the established channel. Fourth, at least for the mature human organism, the inhibition process which constitutes channels is heavily directed by information of a semantic variety. Though it is possible within the model for uncoded information to direct channel constitution, as for example when an unusual sight causes us to examine carefully, it is likely more frequently the case that symbolic mediation is instrumental in constructing further channels and as such in directing the inhibition process. This function of the coded array is familiar to anyone who has tried to "direct the attention" (schedule the information processing) of a pre-verbal or severely intellectually retarded child or an infra-human organism. Directing the attention of another organism without verbal means is very difficult. As Luria (1961) has shown, gaining verbal direction over one's behavior is a developmental achievement. A minor extension of this thinking suggests that the human develops verbal control over much of his information selection by self-instructions on the coded portion of its informational array. The educational ramifications of this conceptualization are obvious.

The coded portion of the informational array has one additional function which serves to direct information processing. The disruption of a channel by any of the above-mentioned means naturally leads to the constitution of a new channel. However, our immediate experience does not appear seriated into successive channels; instead, we are guided by a conception of a central task, however many times we are "interrupted" by shifts in the specific information being processed. Even when task-irrelevant information has signal value and becomes constituted into a channel, the person is typically able to resume his original task.

The simplest explanation as to why the organism can return to the original task is that a sufficient portion of the information concerned with the task is still available on the array or continues to be supplied by the environment. This explanation fails for distractions longer than 15 seconds (the coded array's approximate signal life), particularly when the original task is entirely mental. Thus, unless some representation of the original task is maintained throughout the distraction period, some additional mechanism is needed to explain how the organism knows it has been distracted.

The difficulty is in explaining how a person totally distracted from his task (1) knows he was distracted and so does not proceed "aimlessly" and (2) can remember what the central task was in order to resume it. It is the first portion that presents problems. One cannot simply assume that the external stimulus environment will cue the appropriate behavior again once the distractor channel has satiated. Such a fortuitous mechanism is not consistent with the directed, purposive behavior humans exhibit. Further, adults, and perhaps children, are able to return to strictly mental tasks after being distracted even though there are no external cues with which to reconstitute the old channel.

One simple initial assumption is that if no representation of the original task remains on the informational array and no environmental cues are present to cue the behavior, then the distractor information will have to be removed by one of the previously listed procedures, e.g., satiation, competition by other signals, etc. As the array becomes available, the organism is left with the problem of returning to the original task.

The information-integration theory posits a hierarchy of informational inputs which was described previously as varying from person to person and within each person from situation to situation. Part of cognitive development entails utilizing one's own mentation, increasing its probability of selection as an input. Even if distracted for a period of time sufficient to remove totally from the coded array any recollection of the central task, the human is trained to utilize mentation regularly to guide his behavior ("to know what you're doing"). Hence, an adult will typically process his own mentation after a distraction, sometimes even using specific verbal prompts such as "Now where was I." Such an orientation "inward" for direction removes one from the vagaries of the external stimulus environment.

The Theory need additionally account for the presence of the central task ideation when the mentation source is sampled. Why of all possible thoughts does the person select those relating to the original task?

It must be recognized that the person does not, in fact, always select the appropriate information from thought that will return him to the original task. People do get side tracked; many tasks never get finished. However, more typically at least in the short run, processing of the mentation source supplies the information with which to resume the original task. While at times it is necessary to add a self-instruction like "What was I just doing?" or "Where was I?", such instances do not seem different in kind from a time-linked access of memory requesting a statement of the organism's recent activities which also have the character of importance to the organism i.e., a central task. There is considerable evidence that humans code time as part of their experience as demonstrated most convincingly by the research on judgment of recency (cf., Hinrichs, 1968). The present theory's integrational emphasis can readily account for why recency and importance to the organism can serve as retrieval cues as these were integrated with other aspects of the experience being sought from memory.

The explicit or implicit use of temporal retrieval cues may not entirely satisfy the issue of how a person can remember what he was doing prior to being distracted. People speak of having something "on their mind" or say they want to "sleep on it" or experience thoughts as intrusively seeking expression as when one is troubled by an important problem or upon experiencing a difficult situation will say "I can't get it out of my mind". These expressions all imply that there might exist neural activity in the imaginal system which exists far longer than material on either the uncoded or coded array. Without going into great detail here, I would assert that input from mentation may be inadequately conceived of as information in data bins with various retrieval tags (e.g., Yntema & Trask, 1963) but plays a more active role in becoming expressed on the informational array. The signal life of neural activity in the imaginal system may simply be longer than that on the array. Alternatively, or perhaps additionally, some imaginal activity may be stimulated by such a wide variety of cue conditions or omnipresent cue conditions such as the person's own bodily state that they are active considerably often.

Returning to the immediate question of how the distracted person can remember the original task once he has chosen to process his mentation source, we arrive at a somewhat different explanation. Instead of postulating that the person utilizes temporal retrieval tags, he may simply have the central task more available by virtue of it still being more active in the imaginal system than is older material. This explanation has the disadvantage of requiring the postulation of a signal life for imaginal activity that is different from the representation of the same material on the coded informational array but has the advantage that it meets with immediate experience and suggests many interesting questions about the workings of thought. Obviously, this issue deserves careful study.

Summary. The coded portion of the informational array is critically important in directing information processing and, in so doing, maintaining continuity in mental and motoric activity. The long signal life of coded array material and the coded array's rehearsal capability provide stability by keeping the array active and, hence, less accessible to task-irrelevant information. The coded array also can represent self-induced sets and instructions which aid in the coding of raw analyzer data, thereby increasing their signal life which in turn provides processing stability. Instructions on the coded array also serve to direct the inhibitory processes in a manner analogous to when one requests of another that he "watch carefully". Such instructions serve as cues for the inhibitory system, particularly necessary in novel situations. (They would be expected to become redundant with the external cues in practiced situations and would likely drop out inasmuch as they require productive effort.) Finally, the coded array is instrumental in the organism's recognition that he has been distracted from his original task and in returning processing to the original task. Either by retrieving recent-important events or by aspects of the original task still being active in the imaginal system, the coded array aids in reestablishing the processing of the original task's information.

Role of Anxiety

The function of anxiety has played a central role in theories as diverse as Psychoanalysis and Hull-Spence Drive Theory. The concept's absence in information-processing models constitutes an oversight not satisfied by appealing to the so-called cognitive nature of these models. It is the view of the Information-Integration Theory that behavior must be conceptualized broadly enough to provide at least minimal bridging between areas of thought. Cognitive psychology has been particularly isolationistic, its often cited survey text (Neisser's Cognitive Psychology) containing not a single subject index reference to anxiety, drive or motivation.

A central issue in the experimental literature on anxiety which has stimulated two decades of research concerns whether anxiety's influence acts through drive level or cue base variation. The drive position of Spence (1958) has argued that emotionality acts through changes in drive (D) and that performance on learning and performance tasks is predictable from the hypothesized multiplicative relationship between D and habit (H).

The opposing position, well articulated by Child (1954), holds that anxiety adds new stimuli to the organism's immediate cue base, thereby modifying his performance through changes in the habit component of behavior.

It would be glib to assert that voluminous research supports both positions as such is usually the case when opposing theories square off on a specific issue. Nevertheless, I have always felt that viewing the drive and habit interpretations of anxiety as disjunctive represents a dysfunctional slavishness to Occum's razor.

The phenomenon of anxiety is a complicated one within the Information-Integration Theory. Though parsimony is not served, the complex phenomenon of anxiety may be more accurately represented than by the unitary action posited by the drive and response interference (habit) positions.

A wide variety of events can come to stimulate patterns of activity within the autonomic nervous system. The prototypic cues are intense, unexpected, noxious sensory signals such as loud noises, rapid movement, and the like. The defensive response (DR) elicited by cues of this type is characteristic of that which can come to be evoked by informational content which the organism perceives as threatening (Sokolov, 1960). Without dwelling on the issues surrounding how content can come to be noxious to the organism, let us consider the effects such signals will have on information processing within the context of the Information-Integration Theory.

Two aspects of the processing system will be affected, the inhibition process and the array content. Inhibition will be affected by changes in reticular activating system (RAS) stimulation produced either directly as part of the stress reaction or secondarily by feedback from the body's response to stress, for example, by kinesthetic feedback from muscular tension. (The reader familiar with the Spence Drive Theory literature will recognize that this feedback mechanism was frequently utilized as a drive manipulation by having the subject vary muscular force he applied to a dynamometer.) Increase in RAS activity provides more energy for the inhibitory mechanism, greater arousal resulting in more selectivity and, hence, narrower channels (cf. Easterbrook, 1959; Silverman, 1964). The extreme of this condition can be dysfunctional, especially on complex tasks which require processing of information from a wide variety of analyzers and/or input sources. Thus, increased arousal will be facilatory if the task involves information processing over narrowly defined channels but will become increasingly dysfunctional if the heightened inhibition forces channel definition too narrow for the integrational demands of the task. This conceptualization may provide new insights into the interaction frequently found between arousal (drive) and task difficulty (complexity). In the very extreme state, inhibition will gate aspects of the environment that might prove useful for adjustive behavior (cf. Broen, 1969).

The second locus affected by the elicitation of autonomic nervous system activity is the informational array. The primary affect is the processing demand resulting from the increased bodily cues. The information deriving from changes in heart rate, respiration, muscular tension, and the like is costly in that it either must be processed or inhibited. Its intensity suggests that at least some of the information will reach the array. If the signals are of sufficient strength to fall above the organism's decision criteria, his central channel will be reconstituted around the intrusive signal as, for example, when one is startled by a sudden movement in the dark. Often, however, the organism will learn to anticipate anxious situations so that in setting his decision criteria for bodily cues high, he will not be interrupted by them. The cues will still represent a processing demand, however.

These bodily cues have a secondary effect as well. Information on the uncoded array may give rise to labeling (coded array representation) and/or post-array imaginal and/or motoric activity. The nature of the post-array activity will vary from person to person depending on his integrational history. Typically, intense bodily cues evoke interpretive cognitive activity. Consistent with Schachter's theory of emotion (1964), the Information-Integration Theory recognizes that the post-array imaginal activity will be a function not only of the discrete pattern of bodily cues, which may not in and of themselves be sufficient to discriminate between emotional states, but also of the information simultaneously derived from the environment (sensory analyzers) and its interpretation (mentation). Different emotions (coded array labels and post-array imaginal and motoric activity) may derive from similar bodily states accompanied by different situational information derived from the senses and mentation.

In addition to the imaginal activity, motoric activity may flow from the information on the array. Typically, avoidance behavior is initiated wherever possible. The execution of the avoidance behavior and the kinesthetic feedback from it place further demands on the informational array.

The informational array need be thought of as fluid, entertaining information from the bodily state, from the labeling of these states, from the external environment, and from the feedback sources of mentation and kinesthesis. Termination or suspension of the emotional state will result from either (1) when the instigating source is removed and the bodily and mental activity fail mutually to restimulate each other, (2) when the organism removes itself from the stimulating conditions and the derivative activity as above fails to be restimulated, or (3) when one of the information sources responsible for maintaining the state satiates. Note that it is possible within this Theory for the emotional activity to persist or be reinstated long after the instigating source is removed. The bodily state and the mentation system can mutually provide the necessary array cues to evoke activity in the other. This positive feedback loop is particularly likely when arousal is pathologically high such that sensory input that could provide information disconfirming the appropriateness of the emotional state is inhibited from entering the array.

The demands on the information processing system from bodily states, mentation, and to some extent from the execution of motoric behavior and its attendant kinesthetic feedback detract from the total capacity available for other processing activities. The reduction of available capacity together with the indiscriminate narrowing of channels under extremely high arousal states interferes with performance on intellectual tasks, especiallv those requiring extensive array space and broad channels formed from multiple sources.

SUMMARY

The Information-Integration Theory seeks an understanding of the laws governing how the organism selects information, and integrates it with other information being input from both the external environment and the organism's internal environment including his bodily sensations, stored memories, and feedback from his motor behavior, and mental reactions to events. The Theory conceives of information as a pattern of neural activity composed of a plethora of unit data. Some patterns require more units of information than others for understanding to result and, hence, demand more of the organism's limited capacity. Linguistic materials are characterized by demanding considerable array space. Entrance of information onto the array is modulated by an inhibitory process wording in conjunction with the organism's discriminative sensitivity which admit information for processing if it deviates significantly from that occupying the array. Inhibition can be applied to specific inputs to make them less discriminable thereby limit their processing. Uninhibited material constitutes the central processing channel, by the hierarchical organization of unit data throughout the organism's development. Signals still deviant from the array data, once any inhibitory force has been taken into account, will cause him to discontinue processing the ongoing information-channel in favor of processing further in deviant input. Decision criteria and the inhibition process are directed by the information on the array and, hence, are situation-specific.

Information enters the array in parallel until the array capacity is reached, input being received from sensory input, bodily states such as heart rate and hunger, feedback from motoric activity, and mentation. The continued input registered from these sources, particularly from motor and mental feedback, provide exceptional continuity to the organism's array content which constitutes his immediate cue base off of which further behavior is generated.

The information on the array can be distinguished by its signal life, raw data from the sensory analyzers, from kinesthetic feedback, and from other bodily sources, having a very brief life; coded material such as linguistically coded input, thought and visual imagery has a life span as much as 15 times longer. In addition to longer signal life, coded material also has the advantage of being extremely efficient by representing only the most critical aspects of the event and by being regenerable, either as productive thought or as rehearsal of information already on the coded portion of the array. The efficiency and regenerability of the coded material add immeasureably to the processing power of the system.

By virtue of the varied information simultaneously available to the organism and his tendency to respond to broad patterns of neural activity, many contemporaneousaspects of an event will be integrated into a single recollection. The resulting multi-dimensionality of memories significantly aids their retrieval at a later time and their stimulation by similar neural patterns of information to take on new meaning by association with other coexisting patterns. This process requires that one of the repetitive neural patterns on the informational array first be capable of exciting post-array neural activity either in the form of efferent or mental (imagery or thought) activity. The post-array neural activity constitutes the meaning of an event. Integration is a process by which a novel, repeating pattern of neural activity on the array contemporaneous with a known pattern comes to evoke similar post-array neural activity, the post-array activity resulting from their contemporaneous airing on the array results in unique (creative) thoughts. Integration is limited by array size which restricts the amount of information that can be simultaneously displayed.

Stimulation of post-array activity is critical if the organism is to continue processing a given information source. The progenerative hypothesis formalizing this assertion states that an informational source whose input stimulates the motor or imaginal systems will be sought after while a source whose input fails to be stimulating will come to occupy a lower position in the organism's information-selection hierarchy and, hence, be less frequently selected.

The organism's output (motoric behavior of speech and the musculature) is organized and monitored through feedback by the informational array and, hence, draws upon the same limited capacity as does information reception and integration. Dependence on feedback to generate further behavior is noted when disruption of the feedback occurs as in sensory deprivation, delayed auditory feedback, and anaesthesia.

The selection of information and its integration in the service of stimulating motoric and mental activity is not just one task but is the task the organism engages in to bring about his adjustment to his external and internal environment. Idiosyncrasies in the structural of functional characteristics of the system together with the specific information encountered serve to mold a unique organism. Educational disabilities, described in the following section, derive from these idiosyncrasies, particularly from disorders within the information-integration system.

APPLICATION OF THE INFORMATION-INTEGRATION THEORY TO READING ACQUISITION AND READING DISABILITY

In this second major section, the Information-Integration Theory will be used to conceptualize the problems of children having school difficulties. I shall first consider a few general problems about the application of the theory to educational difficulties, particularly those problems concerned with the use of categories (diagnosis). Then, the Information-Integration Theory is used to generate a model of normal reading acquisition. Next, I consider the construct of "short attention span" solely in terms of receptor orienting acts, that is in terms of the physical orientation of the receptors as opposed to the internal selection of information. Following this discussion of attention span, problems in reading are discussed by describing the various possible process deficiencies which could mediate reading failure and the theoretical syndrome pictures that would be expected from the Information-Integration Model.

THE ISSUE OF CATEGORIZATION (DIAGNOSIS)

There appears to exist a trend today in special education away from categorizing in favor of a treatment of each child as an individual. Through the use of specific diagnostic tests, it is thought that a unique remedial program can be instituted for each child provided that the necessary resources are available. Thus, no need is seen for first classifying the child into a specific disability type. The argument follows that having the child classified as a specific disability type does not aid in the construction of the remedial program nor does it yield additional information about the child's disability as would be required of a useful category-classification system. Consequently, the process of classifying children into types has been discredited. Whether or not one chooses to classify using a category system depends heavily on the uses to which one would put the resulting information and whether for those purposes the system of classification is valid (Zigler & Phillips, 1961). There are a number of basic questions concerning categorization that I would like to comment on, though no attempt will be made to treat these issues in detail. The first is why one should or should not categorize. In these following remarks I am thinking specifically about the area of special education although they equally apply to other areas where deviant behavior is under consideration. There are many reasons arguing for a categorization process as there are many arguing against it. The issue should not be resolved as to whether everyone at all times and for all purposes should or should not use a categorization procedure but rather whether for a given purpose at a given time the virtues of categorization outweigh the attendant problems.

The benefits of categorization. Arguing in favor of the categorization process are the following reasons: First, categories serve a large number of administrative and budgetary functions. From Federal Government programs down to the operating of a single classroom, the distribution of resources, the administration of programs, and the accounting and record-keeping procedures are all highly dependent on some category system. Secondly, category labels serve many sociological functions, as for example allowing for the creation of ACLD and other similar organizations which can use the diagnostic labels as a source of their group's cohesiveness and the basis of their interest group. These groups in turn serve other functions, in particular the individual needs of the group members. Third, labels (category names) serve as a communicative shorthand for persons working in the area. As a shorthand, the labels may be no more than descriptive but do provide a simple and direct manner of communication. Besides serving as a communicative shorthand, labels should yield additional information. Details about the child one loses in categorization should be offset by gaining knowledge in the form of established correlates of the category classes. Thus, for example, the use of the term Trainable Mental Retarded as opposed to Educable Mental Retarded makes a number of statements about the type of remedial program that is appropriate for a child diagnosed as either of these two categories. The category label carries with it a prediction as to the child's ability to function in a certain remedial setting and to gain from it. This represents just one of the many correlates one would hope all category classes would carry with them.

One final benefit of category systems relates to the notion that categorization yields additional information through the class having established correlates. This is that categories form the basis of a research approach which seeks correlates to established classes. Our major research methodology in studying deviance has been to establish a class of deviant behavior and then to study how persons in that class differ from those designated as normal. The very logic of this approach requires the presence of well-defined classes such that persons can be reliably assigned to those classes on the basis of the class principles and then research can study persons reliably assigned to the class to find out other important aspects of their functioning (class correlates) which may then relate to prevention, management, remediation, and prognosis. The total abandonment of classes would mean the necessary abandonment of this research approach, and it is not clear what means of expanding knowledge of deviant behavior would take its place.

The dangers of categorization. At the same time there are many reasons why category systems should not be used. These include the possibility and often the likelihood that the person labeled will become stigmatized. Though being labeled "learning disabled" may bring additional resources to a child's aid, the label itself may constitute for the child a personal problem in addition to the disability itself. Secondly, diagnosis, as a process of putting persons into category classes, is costly. A good deal of professional time and energy as well as the child's time is expended. One could argue whether this time and energy could be put to better use in a remedial effort. Third, error in diagnosis which labels a child as deviant, when he may not be, can exacerbate a minor adjustment problem the child is having or even create one. We know from research that teacher and parent expectations are important forces in a child's life. Being labeled and being acted towards by significant adults as deviant can serve as a stimulus for deviance itself. Finally, the creation of classes and the use of these labels can reify our own thinking, making us believe in the existence of types of problems which may only exist in the mind of the observer. Continued usage of labels tends to become self-perpetuating as, for example, our over-use today of the hyperkinetic diagnosis. By failing to specify clearly the class principles by which the hyperkinetic diagnosis is to be applied, we have allowed for the gross over-use of the term and the subsequent administration of drugs to a huge population of children. The very over-use of the diagnosis and the subsequent drug treatment themselves tend to perpetuate the use of the term and our belief in the existence of such a disease entity.

The reasons for and against categorizing given above could certainly be expanded. The main point I am trying to make here though is that whether or not one categorizes is based on a whole host of considerations. Whether or not one overtly utilizes a category system should be determined through a careful consideration of the available systems and the value and costs of applying them. Through such a procedure a practitioner in one setting may decide it is not to his advantage to engage in a lengthy diagnostic venture where another practitioner in a different setting with different resources may make the opposite decision. Further, the researcher may require that the subjects of his research be carefully categorized. In no case, however, should it be sufficient that one not categorize because dispensing with category labels is presently fadish.

Categorization as inevitable. The second major point to be made about categorization is that it occurs whether or not one formally uses a category system. The very language system that we use is essentially a categorization process whereby a host of behaviors becomes subsumed under a single work. For example, describing a child as impulsive is in a sense a category label used to describe many different behaviors which have in common some abstract characteristic noted by the meaning of the word impulsive. I would claim also that the process of classification goes on naturally to a further extent in that the virtue of experience is in part the noting of regularities and applying to subsequent cases the knowledge gained from previous ones that appear to have been similar. The very notion that we are able to talk of two children as having a similar problem substantiates the existence of an implicit category system. Though it is laudable to approach each child as an individual, one should not mistake this philosophical stance with the goals of a remedial technology. One can approach a child as though he were an individual person with whom one is concerned while using knowledge gained from helping children with similar problems just as a good physician will make his patient feel like an individual and of individual concern to him even though he is treating a disorder which is routine in his experience. The fact that there is order and patterning in educational disabilities is not the dehumanizing force in education, anymore than it is the existence of diseases which make the medical profession appear inhuman in their treatment procedures at times. The knowledge gained by the careful study of diseases is to the benefit of those who in the future contract those diseases. Similarly, a careful study of the various educational disabilities is required for the construction of appropriate remedial programs and hopefully, at some point, preventive programs. The benefits of individualized instruction should be applied in conjunction with knowledge about the child's disability, not instead of it.

The need for useful categories. If my contention is correct that categorization goes on implicitly, the real issue would seem to be whether the categories which are researched are those which the practitioner uses, and whether either the categories used by the researcher or those of the practitioner have validity. The general dissatisfaction with categorizing, that is with the diagnostic enterprise, to my mind springs from the disjunction between the level of knowledge required by the practitioner and that produced by the categorization process. It is a routine event to have a child sent to a clinic because he is failing in school only to have him diagnosed as a "learning disability" case. Is it any wonder that the referring teacher has no patience for this type of diagnostic effort? I would claim that what is needed is not less diagnosis but a better one. In essence, our diagnostic systems are geared to very broad categorization. For example, we distinguish between mental retardation and learning disabilities. The practitioner, usually specializing in one of these two areas, is more concerned about distinctions within each group than those between the two groups. Consequently, a diagnosis which involves solely the use of one of those two labels is not at all helpful. It is for this reason that the so-called reading diagnostic tests and other basic skill diagnostic tests have gained so in popularity. They attempt to describe the functioning of individual subskills and hence provide the teacher with useful information about each pupil. Were there a diagnostic system which described the functioning of the child which was relevant to the teacher's intervention program such that classification of the child dictated a certain optimal program validated by evaluation research, the teacher would likely accept such a system. Thus, it would appear that the problem with our present diagnosis is that it is simply not useful. It is the fault not of the logic of categorization but the level at which categorization has proceeded in the field of special education.

Categories as various adjustments to disability. A final consideration concerning the use of categories is the issue of what the categories one uses actually represent; are the categories discrete entities as they are typically thought to be within a medical orientation? Or are we dealing with continuous dimensions which we divide into discrete categories rather arbitrarily as, for example, the distinction between the trainable and educable retarded child where presumably there is a simple quantitative difference between the intellectual skills of children in each of the two categories?

In the first case, that of diseases, the basis for categorization is thought to be truly dichotomous, one either having or not having a given pathological characteristic. This thinking, however, is likely deceptively simple even within the medical context where the applicability of this approach is more sound for infectious diseases but loses its clarity when applied to systemic diseases. Whereas one can test for the presence of an infectious agent and state at a given level of confidence whether it is present in some degree or entirely absent, one has a different problem in determining how much systemic malfunction one will tolerate prior to imposing a disease label. For example, how much sugar in the urine will one tolerate prior to diagnosing the condition as diabetes. In fact, the recognition that health and disease are not dichotomous has led many physicians to a unified theory of disease. This conceptualizes disease in terms of the total functioning of the individual. A disease within this systmm is not a specific entity apart from the person but is a part of the person's total adjustment pattern.

This approach has ramifications for special education. In fact, the approach of the special educator in attempting to treat the whole child and not a single disorder is consistent with this way of thinking. The physician treating a diabetic patient within this framework would be concerned with the total adjustment of the individual to the specific disorder and would be cognizant of the fact that the person's total adjustment is altered by the presence of malfunction within a relatively circumscribed system. Similarly, the educational specialist need recognize not only that he treat the entire individual but also that he requires specific, detailed understanding of the various processes which can malfunction. The unified theory of disease does suggest an abandonment of one's understanding of one's research into specific infectious or systemic disorders but rather that one expand one's concern for these disorders by placing them in the context of the total adjustment pattern of the organism. Similarly, in special education, we need an understanding of the specific disabilities encountered by LD children even though we tend to cast these disorders appropriately, I think, in terms of the child's total socio-educational adjustment.

There is one additional parallel in special education suggested by the unified theory of disease. Diseases are best not conceptualized as present or absent but rather in terms of the degree of severity as measured by their total impact on the organism's functioning. One person with a viral infection, for example, will have severe respiratory involvement but otherwise will be unaffected and be able to carry on pretty much as usual, while another, similarly infected and having an equally severe respiratory reaction will also respond with a gastro-intestinal disorder and be nearly incapacitated. Analogously, the degree of severity of a process disorder may not be the best predictor of the total educational functioning. Rather, we need to examine the wide range of functioning relevant to success in school and examine the child's pattern of functioning and not simply an independent assessment of various subskills.

Within the context of the present theory described in the first section of this paper, the task would be to pinpoint areas where disabled functioning might have ramifications for the total adjustment to the educational enterprise. A type of disorder or category of disability would not be thought of as constituting a specific type of individual discreetly different from all other individuals, but rather would constitute a core problem to which the total system must adjust. Disability is conceptualized in terms of a specific problem in some area of information processing and the subsequent adjustment of the person to that disability. Deviant functioning is to be understood in the same theoretical context as in normal functioning with the exception that some specific area of functioning presents a problem to which the whole information processing and integration system must adjust. Processes dependent upon the disabled process for their proper functioning will show disorder while other processes may be called upon to provide extra service in order to compensate for the disability. To understand these complexities, one clearly needs a testable theory specifying the relationships between a finite set of processes such that patterns of disabled functioning can be discerned and potentially validated.

The section on receptor orienting acts which follows the theory of normal reading acquisition illustrates the dependence of even the simplest overt attending behavior on the total functioning information-integration system. The main thesis of this section is that global terms like "short attention span" fail to recognize the interdependence of this behavior on the total information-processing system. A short attention span, it is argued, can have many meanings depending upon the specific situation in which it occurs and on the other disabled processes with which it occurs.

THEORY OF NORMAL READING ACQUISITION

Understanding reading disability would best proceed through an understanding of normal reading development. We need a substantiated theory of reading acquisition within which disabled functioning can be understood. The Information-Integration theory laid down in the first section of this paper provides the basis of a theory of reading acquisition. The theory of normal reading acquisition which follows is somewhat sketchy, concentrating its focus on a delineation of the processes important for normal reading. To be fully complete, the theory would need to cast these processes in a development context, specifying the sequence of developmental skills and the level of skill acquisition necessary for adequate reading behavior. The theory laid down in the previous section, while heavily concerned with process rather than structure, is not specifically developmental in nature. However, the theory of normal reading, does provide an adequate framework to describe the various possible types of difficulty encountered by the learning disabled child.

Receptor Orienting Acts

The most basic requirement for a child's learning to read is that he orient his eyes toward the printed page. Though obvious, this widely recognized point has led to considerable misunderstanding in the field of special education. Children who fail to look at their schoolwork are frequently labeled as having "short attention spans". Such a term implies that the child's failure to attend behaviorally is evidence for some underlying process deficit, namely, that his attention span is pathologically short. I believe a construct of this variety is terribly misleading, so much so that I have devoted a section of the paper to a discussion of receptor orienting acts. In this section, I describe how such a term as "short attetnion span" obscures important aspects of the overt behavior which once recognized would yield a better understanding of the inattention toward the printed page. As these issues will be discussed below, at this point it is only important to recognize the obvious fact that for appropriate reading acquisition, the child must possess adequate, overt attending behavior.

Analyzer Integrity

Given that the child orients his eyes towards the page, his visual analyzers must be capable of transmitting the graphic information to his informational array. The critical analyzers, those which together yield information about form, must be structurally intact and functioning properly. Just as visual acuity is limited by the accommodation of the eyes' lens, so too is the ability to discriminate form (graphemes) limited by the neural data provided by the relevant analyzers.

Structural integrity. There are essentially two major reasons for analyzer failure, one structural and the other functional. Though research on analyzers is in its infancy, we do know that specific neural and receptor cells and combinations of these cells are differentially responsive to unique aspects of the stimulus environment. It is logically possible that there exist structural defects in the neural cell combinations which form basic analyzers just as there exist known organic defects in sensory receptors and other bodily organs. Some degree of structural integrity of those analyzers critical for form discrimination would logically be a necessary requirement for reading. (When I speak of reading here, I mean reading with the eyes, acknowledging the obvious exception that unsighted persons are able "to read" using the Braille method).

Structural integrity includes the notion of adequate signal life. The analyzer output to the informational array would be required to have neither too long nor too short a life-span for normal reading acquisition to occur.

Signal life that is too short would require repeated receptor orienting acts to the printed graphemes to enable their analysis whereas an overly extended signal life could cause interference with subsequent analyzer output. Optimally, the analyzer output to the array responsible for form discrimination should decay in the time period between saccatic eye movements. The eye should fall upon a specific set of graphemes, have the analyzers responsible for form discrimination transmit data to the informational array, have this information utilized and decay while the eye moves to the next pattern of graphemes which then begins the cycle anew.

Functional integrity. The analyzers responsible for providing information about form must have functional as well as structural integrity. They must actually provide the information to the informational array if reading is to proceed normally. The progenerative hypothesis of the Information-Integration provides the basis for improvement with practice in reading as well as for an understanding of some reading disabilities. This hypothesis states that neural activity which evokes further neural activity will be continued but that neural activity which fails to evoke further neural activity will be discontinued. As reading develops normally, the beginning reader becomes increasingly capable of having the graphic symbols represented as form analyzer patterns on his informational array generate neural activity in the imaginal system (meaning and associations). The flow of neural activity from the informational array (experienced as thought or imagery) constitutes the major condition for increasing the likelihood that the form analyzers will transmit their data to the informational array in the future. Thus, the more successful the child is in extracting the meaning from the graphic symbols, the more attuned he will become to selecting form analyzer information to occupy informational-array space. This postulate that the accuracy of perceptual form judgments will increase without informative feedback has been demonstrated by Munsinger and Kessen (1965). If the meaning does not readily flow from the visual information on the informational array, the progenerative hypothesis would work in the reverse fashion lessening the likelihood that form information would be transmitted in the future, thus making reading increasingly difficult as the child ages. This point will be returned to below when considering the specific reading disabilities.

Appropriate Channel Formation

Up to this point there is nothing particularly surprising about the prerequisite skills postulated for normal reading acquisition, the only unique aspects of this theory being that it is couched in the language of the Information-Integration Theory. The theory does have two particularly unique aspects to it, however, one being concerned with the requisite information necessary for the reading process and its use and the second being concerned with the critical role played by the mental activity stimulated by the information on the informational array. These two issues shall be considered in turn.

The most central basic process in normal reading acquisition involves the simultaneous processing of a set of one or more graphemes together with the neural equivalent on the coded informational array of the associated phoneme pattern. Reading acquisition is thus viewed as an integration process whereby the pattern of neural activity which represents the graphic forms on the informational array must occur simultaneously with the neural activity representing the spoken phoneme pattern. According to the Information-Integration Theory, two sets of information must be simultaneously registered, or nearly so, for integration to occur. Integration constitutes the process whereby the mental activity which flows from the phoneme pattern comes to be evoked in the presence of the grapheme pattern.

The phoneme pattern does not exist as part of the reading situation; the child must produce it. Producing the neural activity representing the phoneme may be accomplished either by "imagining" it or by actually saying it out loud; both of these procedures constitute a representation of the phoneme pattern on the coded portion of the informational array, the difference between the two being that the latter, speaking out loud, allows the neural representation on the coded portion of the informational array to evoke the motor behavior necessary for saying the sound out loud, while the former allows only the mental activity (the meaning of the phoneme and its associations) to be evoked.

In order for the meaning, the associations, and the speech sounds corresponding to a phoneme to be evoked by a grapheme, that is for the integration of spoken and written language to occur, three subsidiary processes are necessary: (1) adequate inhibition to provide sufficient array space for the appropriate information, (2) the productive use of mentation which supplies the coded array with the spoken equivalent (phoneme) of the grapheme to be read, and (3) discrimination of the neural pattern on the uncoded array representing the grapheme and of the neural pattern on the coded portion of the array representing the phoneme. These processes are considered below.

Inhibition. Inhibition is the process which serves to select information for the informational array by blocking the transmission of unwanted input. Inhibition is utilized to form the channel containing task-relevant information while blocking access to the informational array of those data which are not relevant to the task at hand. The beginning reader need have appropriate strategies with which to deploy inhibition against unwanted input. For example, in reading one would want to inhibit auditory input, much of one's bodily cues, most of the visual information except that concerned with form discrimination, and most mentation except that concerned with producing the phonemic equivalent of the grapheme being viewed. Just a portion of this task, say that of ignoring movement and color within the visual field, may constitute a huge developmental achievement. Research by Maccoby and others (e.g., Maccoby & Hagan, 1965) has shown that this inhibition of task-irrelevant information within the visual sphere develops throughout elementary school and does not approach adult capability until well into junior high school.

In initial reading acquisition, a major portion of the array need be given over to the analyzer data carrying information about form, and thought data carrying information from storage about the phonetic characteristics of the associated graphemes. At this initial stage of reading words, all other information would be considered task-irrelevant and best inhibited. While such major inhibition is difficult for the young child, his problem is compounded in that the necessary channel to be formed is constituted of two different sets of input, one from the visual sense and the other from the child's own stored material, i.e., mentation. Whereas both of these sources are carrying linguistic information, thought by the Information-Integration theory to be maximally difficult by virtue of their complexity, the visual-mentation channel must be operated efficiently if the child is to read adequately. The less efficient is the inhibition process at inhibiting task-irrelevant information, the more difficult the child will find this initial reading experience.

Productive mentation. Given appropriate receptor orienting acts, and the proper functioning of the analyzers relevant to form discrimination, and the efficient use of the inhibitory mechanism in selecting an appropriate set of grapheme data, the visual portion of the data will automatically come to the uncoded array. The phonemic information, however, needs to be generated by the child himself. This productive requirement adds to the difficulty in initial reading acquisition. These two basic processes necessary for initial reading acquisition, inhibition and mental production, are likely the most critical subskills distinguishing reading acquisition from language acquisition and accounting for the greater number of children who encounter problems in reading than in initial language learning. Because auditory cues are typically more intrusive than visual ones (Weiss, 1961), that is, because auditory cues have a generally higher probability of gaining access to the informational array, fewer demands are placed on the inhibition process when acquiring spoken language than in learning to read. Secondly, the productive problems of speech acquisition are somewhat simplified by the vocal response being public and hence susceptible to shaping by the adult environment. In reading, the internal production of the phonemic equivalent of the grapheme is preferably not vocalized, thereby making the task less susceptible to adult correction. Of course in practice, the child beginning to read is encouraged to say the words "out loud" so that correction can be applied. This process, however, is costly and tedious for adults as it cannot be undertaken in the course of normal every day activity as is the case in language acquisition.

Discrimination. For normal progress in initial reading acquisition to occur, the child must be able to discriminate the grapheme and the associated phonemes in the language. The child must be able to recognize as different and unique each letter or letter combination which gives rise to a unique sound in the language and recognize as unique each of the sounds. It is very important to understand that the child must be able both to recognize the uniqueness of each phonemic as well as each graphic element. While it has empirically turned out to be the case that problems in auditory discrimination hamper reading acquisition, an adequate theoretical explanation of this finding has not been available. The present theory requires that the child produce the appropriate phonemic elements which constitute a word so that the meaning which is evoked by this phonemic pattern can be integrated with the neural pattern generated by the grapheme. An ability to produce the neural equivalent of each of the speech sounds, whether or not this neural pattern is allowed to give rise to vocal behavior, is necessary for the integration process to occur. In this context, a truly expressive language disorder is one which entails difficulty with the motoric output of the neural representation solely and, hence, should not affect the reading process itself except inasmuch as teaching becomes impeded by a communication problem between the pupil and instructor.

There are two more issues that need mentioning here, one concerns the nature of the phonemes produced by the child and the second concerns the learning required in order to discriminate the neural patterns which represent the various graphic elements in the language, for example, "b" and "d".

The neural activity produced by the child which represents the unvoiced equivalent of the grapheme need not be single phonetic units but can be whole words or even phrases. It is entirely feasible that a child taught by the word method, for example, could produce the neural equivalent of the whole word on the coded array rather than produce separately each phoneme. In intermediate cases the syllable might be the unit produced. As reading acquisition progresses and familiarity with the grapheme patterns increases, the size of the unit produced would increase and come to represent the whole word or even small phrases. The principle being stressed here is that some unit of the neural equivalent of spoken language must be produced on the coded array and integrated with the equivalent unit of written language on the uncoded array, be the units graphemes-phonemes, syllables, words, or even phrases. Efficiency dictates that the unit chosen for production be as large as possible and come to approximate the unit from which the meaning of the words can best be understood. For the beginning reader, however, accuracy will be more important than efficiency; knowledge of the phonetic code whether by explicit teaching or through repeated experience in reading, provides the child with the productive capability of generating the neural equivalent of the spoken word from which meaning will be evoked such that the integration process can proceed. The value of phonics lies in this generative capability, allowing the child to "sound out" words, thus yielding the phoneme-meaning neural activity for integration with the grapheme pattern. Phonics, as an instructional program, aids the integration process by helping generate the phoneme-meaning neural activity. The word method, as an instructional procedure, differs from phonics in substituting rote memory for phonic production. Both methods can be seen as having the same goal, that of providing the child with the phoneme-meaning neural activity for use in the integration process with the grapheme pattern. The sometime success of both methods is consequently understandable; reading acquisition generally proceeds in the same manner under both systems, through integration. What differs is the method used to produce the phoneme-meaning neural activity, phonic analysis or rote memory. Each method has its strengths and weakenesses which will be more or less critical depending on the child's specific skills. A child with poor auditory discrimination, for example, would be expected to have great difficulty with a phonic method while the word method would be inappropriate for a memory-disabled child.

As words become more familiar through repeated practice, their presence on the uncoded portion of the array will begin to give rise to the neural equivalent of the word on the coded portion of the informational array which previously had to be produced from mentation by the child. Further on in time, many words will become familiar such that the graphic representation on the informational array will itself be sufficient to give rise to the meaning of the word and the various associations to it without either the need to produce the auditory equivalent or to have the auditory portion evoked by the visual portion. A unique pattern of neural activity which is reliably antecedent to some other pattern of neural activity will come to evoke that neural activity. Thus, the process of integration involves imbuing the visual information (neural uncoded grapheme representations) with the ability to evoke the same meaning and associated mental activity and vocal response as was previously evoked only by the spoken or imagined word. Through the process of integration, the necessity to produce the phonemic equivalent of the word and subsequently the necessity of having the visual equivalent evoke the phonemic equivalent on the coded array prior to its evoking the meaning and associated mental activity are obviated; the meaning then flows directly from the graphic representation itself. This integration process is a continuous one throughout the reader's history such that even the adult reader will at times need to use the most basic productive methods to understand a new word and more typically will have to utilize the auditory translation of the visual grapheme onto the coded portion of the array in order to obtain maximum meaning from the written word. However, for the practiced adult, a large portion of his everyday vocabulary can likely be read by having the meaning directly evoked by the visual information alone.

Finally, comment must be made about the learning history necessary to discriminate the neural patterns on the visual portion of the uncoded informational array. What experience is necessary to allow one to discriminate the neural pattern provided by the analyzers when presented a "b" than when presented a "d"? As Kohler (1947) has shown in his classic demonstrations of reversed visual images, the exact orientation of a stimulus presented visually is quite arbitrary; the person can learn to adjust his reactions to a world even inverted by prisms if only this "distorted" information be consistent. To a subject newly wearing glasses with prisms which invert the visual field, something that appears to be above him will in actuality be below him. Though he will initially reach up for the object, he will quickly learn through repeated practice that an object so perceived is to be grasped by reaching down. The point I wish to draw from these classic demonstrations is that the meaning of any sensory input is determined by its lawful relationship with other known input. Without some correlation with some other neural pattern which is already known, the meaning of a new input cannot be learned. This contention is most clearly demonstrated in the area of perceptual learning. As Held (1965) has shown, the meaning of an object in space cannot be grasped either literally or figuratively by an arm which has been restrained during development. Experiments with monkeys who have had their limbs restrained take a period of time to learn to associate (integrate) the kinesthetic cues from their own movement with those generated by the visual analyzers. In a similar set of studies, Held has shown the importance of the kinesthetic system for perceptual learning in cats. In the context of the present model, the learning of patterns of visual material on the informational array would be seen as gaining meaning through correlated occurrence with the cues on the informational array provided by the kinesthetic feedback from the motor system.

Returning now to the specific problem involved in pattern discrimination, recognizing the difference between two graphemes involves the integration of kinesthetic and perhaps tactile information with that from the visual system. A "b" therefore is different from a "d" in that with reference to one's own body, a "b" is oriented in a different direction than "d". One must, therefore have developed throughout early childhood the ability to integrate kinesthetic experiences with visual ones in order to provide a sound basis for the more intricate visual discriminations necessary for reading. We will see in the next section that failure of this integration of visual and kinesthetic-tactile inputs is postulated to be responsible for the visual discrimination problem so often seen in learning disabled children.

Meaning Evoked by the Coded Array Representation

The integration process by which the visual grapheme comes to evoke the meaning of the auditory equivalent, requires that the beginning reader have the capability not only of producing the neural equivalent of the spoken word but also that this equivalent once produced have the capability of evoking the meaning and associated ideation appropriate to that spoken word. The whole point of the productive aspect of the reading process is that in producing an internal equivalent of the word as it would be voiced begins a chain of mental activity which is the experience of the meaning of the word and the other associations that it evokes. If the generation of the internal equivalent on the coded portion of the array does not serve this function, then the visual pattern cannot come to evoke the meaning of the word either. Thus in addition to the requirement that meaning and associated ideation flow from the internally produced coded representation of the word, the meaning must also be capable of flowing from the visual equivalent, i.e., the integration process must be intact.

Feedback from Mentation

Reading is not so much a process of information transmission from the printed page to the vocal apparatus of the reader as it is a process of understanding, gaining meaning from the collection of words on the page. The meaning of the words in a sentence have to be understood in the context of the other words; similarly, the first sentence of a paragraph has to be taken into consideration to derive the full understanding of the final sentence. So too is it with paragraphs and chapters. Thus, reading involves the construction of an imaginal system.

Within the context of the Information-Integration Theory, this function of higher-order integration is thought to be accomplished by the feedback of mental activity either in the form of thought or non-verbal ideation (imagery) onto the coded portion of the informational array. Thus, some portion of the information processing capabilities need be given over to the thoughts derived from the content of one's reading. Though one may at times pause in one's reading specifically to ponder the content of what one has just read, more typically this process goes on concurrently. The reading of new material does not stop; rather, a portion of the coded information array is used to carry the neural activity which is experienced as thoughts about the reading, typically associations to what one has just read.

This feedback onto the informational array has two central purposes, the first and most important being one of comprehension. In the manner of the integration process, new information being read is combined with the previous information brought back onto the informational array and combined to yield a unique set of mental reactions which would not occur if the feedback were kept off of the informational array.

The second purpose of the feedback onto the informational array is that it helps form a cue base from which the words in the story are made more readily decipherable. This operates through a process of probablistic prognosis, by which the presence of a certain general set of ideas makes it more likely that some words will be present in the immediate future in the story than will some other set of words. Thus, having "in mind" the specific content with which one is dealing, the reading becomes easier by virtue of one being more able to guess what the ensuing words will be. Parenthetically, it could be noted that pictures in the text also serve both of the above purposes, aiding comprehension as well as providing additional cues about the context within which the story is occurring.

I have thus outlined the skills necessary for adequate initial reading and to some extent specified how this basic acquisition process changes with practice. In the following section, I shall discuss the problem of receptor orienting acts and then in the concluding section describe how disability in one or more of the processes necessary for adequate reading acquisition can lead to symptom patterns we see in specific learning disabilities.

RECEPTOR ORIENTING ACTS

It is obvious that learning will be impeded if the child does not orient to the information that is to be learned. Less obvious are the reasons for his failure to attend. It is not enough to claim that the child has a "short attention span", by which is usually meant that the child cannot (or will not) sit in one place and look at or listen to prescribed material for more than a brief period. This inattentive behavior can be caused by a number of diverse factors which the label short attention span can serve to obscure. It is necessary to analyze the short attention span in order to determine its properties, specifically the conditions under which it occurs and, equally important, the conditions under which the child's attention span approaches that of the normal child. This section considers attention solely in terms of overt behavior, receptor orienting acts which bring the child into contact with material to be learned.

There are two basic reasons why knowledge of the conditions under which inadequate receptor orienting acts occur or do not occur is critically important. First, to understand behavior, to know its meaning, one must know the functional relationships between the behavior and its antecedent (eliciting) and consequent (resulting) conditions. As we shall see below, all "short attention spans" though grossly similar are not alike when their antecedent and consequent conditions are considered.

The Behavior's Topography

Prior to considering the various conditions under which short attention spans are evidenced, we shall examine the character of the attending behavior itself as its variations may herald different underlying process deficits. Let us deal in turn with the duration of attention span, its course and variability, whether attention recovers after a reasonable rest period, and the associated affect. These characteristics of attending behavior share the same logical status as the general term attention span. They lack meaning apart from their functional relationships with other variables. For instance, it is all but meaningless to consider how long a child can attend without also considering what he is attending to. It is the characteristics of the inattention in conjunction with the associated conditions under which the behavior occurs that is important. Throughout this discussion, the reader must keep in mind that my point is that the inattentive behavior so frequently labeled "short attention span" is not a single type of behavior but is an overly general term which glosses over important aspects of the attending behavior and the conditions under which it is elicited. Thus, I use the term attention span because it is familiar to the reader while urging its more limited use in favor of a more careful description of the behaviors it subsumes. Also keep in mind that throughout this section, attention refers to overt, receptor orienting behavior and not to the selection of information from the stimulus field.

Duration of attending. The notion of a short attention span literally denotes that the child is unable to divest his attention in a task for as long a continuous period as can the average child his age. The concept is routinely used without reference to the specific task the child is undertaking though it usually is assumed that the task involves educational materials in a classroom setting. Though this assumption is usually met, the specific situation is treated as unimportant relative to the child's trans-situational attentional skills. The short attention span is conceived of as a characteristic of the child that he brings to the school task as opposed to a response of the child to the school task. Though this distinction appears subtle, its implications are not. Failure to specify the conditions under which inattention occurs heavily restricts our understanding of the child's attentional difficulty as will be demonstrated below.

Duration of attention span, whether assessed with reference to specific materials or considered (erroneously I believe) as a characteristic of the child, has important theoretical and pedagogical implications. The pedagogical importance is obvious as any teacher, who has tried to teach a child who persists in looking out the window or more generally into space, will attest. The theoretical importance equally obviously varies with one's theory of attention, here more specifically with one's theory of attentional maintenance. Why does an organism look at anything? And why does he persist in doing so? The Information-Integration Theory views receptor orienting acts as an extension of the information processing system and, hence, under the control of the progenerative mechanism. Just as information which succeeds in generating further neural activity will increase its probability of subsequent selection for the informational array, so too will the probability of those receptor orienting acts which enable that specific information to be selected increase in likelihood. The reverse situation also holds and is more germane to educational disabilities: if information of a certain type fails to stimulate further neural activity, then its selection will become less probable and the attendant receptor orienting acts will decrease in probability in favor of other receptor orienting acts which do yield information which stimulates further neural activity. The child who gazes out the window or bothers his neighbor does so because these activities and the attendant orienting acts provide the child with more imaginal activity than does the material he is supposed to be working on.

The literature contains reference to two types of problems concerned with the duration of processing (attention). One type is represented by the so-called hyperkinetic child whose attention span is measured in seconds unless a barren stimulus environment is provided to eliminate distractions. The second is not so specifically codable and is represented by a large portion of the learning disabled population. Their reduced attention span is more typically measured in minutes. I believe the first case to comprise a sample of children more homogeneous with respect to the reasons for the short attention span than the latter group which may contain children with many more different underlying cognitive problems. A theoretical explanation of these examples of reduced attention span is clearly in order. Because I believe these cases of inadequate receptor orienting behavior are secondary, deriving from disorders in the child's ability to process information, the theoretical exposition more properly belongs in the following section. Let us continue here with a consideration of the dimensions of short attention span behavior followed by an examination of the conditions under which this problem may occur.

Attentional variability. Short attention spans are surely not characterized by optimal functioning for a given period of time followed by minimal functioning. Such abrupt shifts are simply not generally characteristic of biological systems. Rather, a child approached afresh will look at stimulus material and/or appear to listen carefully more so than he will after fifteen minutes of instruction. The probability of the attending behavior will not be constant over time. Neither need its course from attention to inattention be regular. It is conceivable that some children are distractible in the sense that they have low reception thresholds for situational stimuli defined as task-irrelevant. Such a problem would generate an irregular pattern of attending covarying with the presence of distractor stimuli (though fatigue, i.e., satiation for the task-relevant stimulus materials, may add an element of progression to the inattention). Other learning disabled children, being no more distractible than their normal counterparts, would be expected to show a course of attention commensurate with the factor or factors which shorten their attention span.

In addition, the course of attention during the shortened span may be controlled by events only indirectly related to the cognitive disability. For instance, the child's interest in the task may remain minimal throughout his so-called span of attention though he cooperates with the teacher for limited periods of time. The length of his attention span and the progressive inattention in such a case would be a function of the teacher's reinforcing power for the child coupled with certain dispositional characteristics of the child, for example, whether he is cooperative, desirous of pleasing adults, threatened by failure, and so forth.

Recoverability and associated affect. Associated with the course of attending behavior are two extra-behavior considerations: recoverability and affect. What are the necessary conditions for resetting the attentional span, however brief the span itself is? This question, significant for our understanding the bases for short attention spans, has pedagogical consequences: Is the passage of time important in resetting the child's span of attention? What other events besides the passage of time cause the child to approach the task anew? Were one able to answer these questions and control those events, one could command the child's attention. The point here, as before, is that the variables related to attention spans must be systematically studied if the notion of attention span is to attain meaning. My guess is that recoverability of attending is not related to sensory or biological factors but rather that, like the length of attending itself, recoverability is learned behavior under the control of extrinsic, social rewards and punishment. If the passage of time is important in recapturing the child's attention, it is due to the dissipation of anxiety and frustration, i.e., an emotional rather than a cognitive recovery with the passage of time.

If this hypothesis is correct, the affect associated with the shortened attention span would be an important variable for understanding reduced attending. As many skilled teachers are aware, keeping the child's attention is intimately linked with maintaining his confidence while reducing threat of failure. Thus, while emotionality may not initially be responsible for reading failure, its probable role in motivating task-avoidant behavior must be acknowledged. As an aside, I would want to add that theories of reading disability based on emotional mediators and those advocating cognitive process deficits are not mutually exclusive. We need considerable thought and research aimed at understanding the interface between emotion and cognition as opposed to the nearly complete separation which now exists.

Conditions Affecting Receptor Orienting Behavior

The conditions surrounding the production of reduced attending behavior yield information additional to that provided by the characteristics of the behavior itself. Systematic research is required which would first provide reliable indices of attention span and second, provide normative data describing the attending behavior of average children under a variety of school-relevant conditions. The global notion of "short attention span" loses all meaning when considered in light of the situational variables discussed below.

Input modality. Treated as though it were a characteristic of the child, attention span is sometimes thought to be modality specific, each sensory modality having its associated attention span. In educational fields, the visual and auditory attention spans are the ones considered. Though a refinement over the global attention span concept, visual and auditory attention spans retain the notion that the problem is a characteristic of the child and not also situationally determined. What one is really interested in is not whether a child will orient his receptors but that he will encode the information he receives. The attentional acts are prerequisites for receiving information and are likely controlled by the degree of success in this endeavor. Therefore, their functioning should be considered in relation to the information. Were one to find that the nature of the information is not relevant to the lowered attention span, that is if duration of attention is lower than average across a wide variety of stimulus conditions, then one would have some basis for using the global term "short attention span". But one must end up with this designation after demonstrating that the attending decrement is trans-situational, not begin with it after only limited observation within the restricted stimulus conditions of the school room. A wide variety of situational variables in addition to the modality of the stimuli involved, need to be considered.

Situational variables. The situational variables that must be considered in order to understand receptor orienting acts include dimensions of the task at hand, the situational context, the presence of distractors, and the immediate rewards for attending, both extrinsic and intrinsic, together with the reward history for attending in the given situational context. As these are all complex dimensions in need of systematic analysis, I shall only comment by way of illustration on the relevance of each.

Though obviously important in maintaining attention, the nature of the task is implicitly ignored when a child's attention span is noted; in fact, his attention may wander only on school-related tasks, perhaps only on those school tasks in which he is deficient. One must ask, "does his attention wander during a baseball game?" or "while playing with trucks in the backyard?" I push this obvious point because I believe that for the bulk of the children said to have short attention spans, the problem is specific to quite circumscribed stimulus conditions, which makes the label "short attention span" terribly misleading. Though it is also likely that a child's inattention generalizes to tasks he is capable of accomplishing and hence comes to resemble a more pervasive deficit, it behooves us to distinguish whether the child is unable to control his attention, whether he fails to derive the information sufficient to maintain attention (processing), or whether he has learned to avoid certain types of encounters because they prove to be punishing.

Let us consider the reward context next. There is no reason to believe receptor orienting acts are not influenced by rewards and punishments as are other responses. Orienting to and maintaining focus on material in a context where failure is likely is, indeed, a tall order. I hasten to add that I have presented no data to demonstrate that rewards and punishments are relevant variables determining receptor orienting behavior but have only indicated my confidence in this assertion. The recent popularity of behavior modification, a framework within which this immediate discussion could fit, has led to an uncritical over-acceptance of claims based on the law of effect. It is not enough to assert that relief from the anxiety and frustration or failure motivate inattention. More basically, to claim that rewards and punishments are controlling a given behavior, one need demonstrate that manipulation of the reward-punishment contingencies causes commensurate changes in the target behavior. I believe that such an analysis would verify that for many learning disabled children, avoidance (inattention) is motivated by punishment and the relief from discomfort and that scheduled rewards, both primary and social, can significantly affect this picture. However, one must keep sight of the historical context: why has one child failed thereby causing us to utilize extrinsic rewards to recapture his attention while another child engrossed in his schoolwork has no need for our praise or tokens? The effectiveness of a reward in modifying behavior does not logically imply that the previous behavior was due to an absence of the reward anymore than the elimination of a headache by the administration of aspirin demonstrates that the headache was caused by an aspirin deficiency. One still must answer the question why the child failed in the first place: the correct answer may, indeed, be that he failed to be rewarded but this would have to be proven, not assumed from the evidence that reward is capable of altering the target behavior. I stress this point because I believe the administration of extrinsic rewards to encourage attending are prophylactic at best; if useful in teaching the child, they certainly should be administered but we should not let the recent popularity of behavior modification deceive us into thinking that the child's interest in learning derives from well-timed praise and M & M's. The danger is that one stops searching for the reasons why children fail in school if one can make some inroads into the problem by shaping their skills with well-timed rewards. If we are so deceived, we are left with a weak remedial technology and little knowledge of the underlying process deficits or their causes.

A final major dimension important in assessing attention span is the role played by distractor stimuli. Distractor stimuli, defined simply as information irrelevant to the central task, by their very nature impede performance if they are process instead of the task-relevant material. Their detrimental effect acts on the adequate as well as the retarded reader. They may, however, be differentially important in their effect on the receptor orienting acts of those learning disabled children with (organic) minimal cerebral dysfunction. Considerable evidence with brain-injured adults shows that performance on copying tasks is differentially impaired by visual distraction and this fact has been used to aid in the diagnosis of brain damage (Adams, 1969). Whether or not all performance deterioration in excess of that experienced by the average child under conditions of high distraction are due to brain lesions is a very difficult question to answer. Nevertheless, marked deterioration of attentional skills under distraction conditions may herald a unique process deficit, whether organically mediated or not and, hence, deserves our attention. Given that classrooms tend to be loaded with visual and auditory distractors, those children whose attentional skills markedly recover in impoverished stimulus environments may share a common mediating deficit. I would expect that the children isolated by such a procedure would be those diagnosed hyperkinetic by psychoeducational-neurological batteries.

Summary. In this section, I have described some of the situational factors important in assessing the child's gross attentional (receptor orienting) behavior. Knowledge of how the attending is modified by the stimulus modality of the central task, by the situational context of the task and the nature of the task, by extrinsic reinforcement and the child's reinforcement history, and by distractors in the situation would add immeasurably to our understanding of the inattention. The global concept "short attention span", applied to so many learning disabled children, obscures so many critical distinctions that it covers more information than it conveys. It remains important to note each child's attentional limits and even more important to examine the conditions under which the attentional problem is exacerbated or ameliorated. This more detailed assessment of the receptor orienting behavior can provide important clues as to the nature of the child's learning disability as illustrated in the following section.

SPECIFIC LEARNING DISABILITIES

I have tried to show in the previous section how a behavior as complex as the orientation of the receptors to the educational material is likely under the control of a wide variety of different variables. As such, using this behavioral index as a measure of a single construct, "short attention span", thought to reflect a capacity of the child, would seem to be inappropriate. As previously discussed, receptor orienting behavior is under control of both extrinsic and intrinsic rewards; it is the spirit of the Information-Integration Theory that the intrinsic rewards are the stronger of the two in the educational situation. Extrinsic rewards such as candy, checks and tokens negotiable for material goods, and even praise as used by behavioral management technicians are only necessary when the child's disabled functioning prevents him from attaining the intrinsic satisfaction from learning.

The specific disabilities considered in this section are concerned with irregularities in function within the context of the Information-Integration Theory. Inadequate receptor orienting activity is nearly always characteristic of each specific learning disability but often for different reasons. The exact character of the inadequate receptor orienting behavior is sometimes predictable from the specific disability posited. Hence, receptor orienting behavior will be considered as derivative, secondary to other disorders of information processing and organization, and not as reflecting a primary disability itself. Four categories of specific learning disabilities are considered below: (1) disabilities deriving from the failure to receive proper information on the array, (2) disabilities deriving from the failure to produce the proper information for the informational array, (3) disabilities deriving from the failure of the informational array to evoke neural activity in the imaginal system and (4) disabilities deriving from task-irrelevant content occupying the informational array.

Failure to Receive Proper Information on the Array

Reading acquisition will be adversely affected if the necessary information fails to be received on the informational array. A number of processing disorders could be characterized by the different reasons for the appropriate information failing to reach the array including (1) defective analyzers for form, (2) irregular signal life of visual information, (3) inadequate channel formation due to ineffective inhibition, and (4) visual information being low in the information-selection hierarchy. These disorders and the associated behavior deduced from the Information-Integration Theory are discussed in turn.

Defective analyzers for form. A most basic type of reading disability would result were the analyzers which carry information about form defective. Typically, learning disabilities are defined in the absence of sensory disorders (Clements, 1966) so that it is germane to question whether defective analyzers constitute a sensory or a central processing dysfunction. This issue is to some extent definitional; however, analyzers typically are not single receptor cells but instead are combinations of receptor and neural cells which act together to produce a specific type of information about the environment. Subtle and exact relationships are required between the elements within an analyzer in order for it to transmit its specific information, at least as far as our understanding of these systems allows us to speculate (Lindsey & Norman, 1972). Thus, analyzers are not truly sensory nor are they solely central in that the sensory receptors are an integral part of the analyzer mechanism. The more important basis for distinction would perhaps be that in not being strictly sensory, analyzer defects would not be readily corrected by known ophthalmic techniques.

Defective form analyzers would have a simple and direct effect on reading; the child would have an insufficient amount of data on the informational array concerning the form of the graphemes in order to make the necessary discriminations. Despite the simplicity of this hypothesis, it would be exceedingly difficult to assess whether a child was having difficulties of this basic kind. While problems in visual discrimination tasks might be caused by defective analyzers, the possibility remains that poor visual discrimination performance could occur even though the form analyzers were structurally intact. Such could occur for at least two reasons. First, the probability that form analyzer data entered the array could be extremely low due to inadequate extrinsic or intrinsic rewards for selecting this information. Second, the child could have failed to integrate form data with other information especially kinesthetic and hence, according to the basic tenet of the Information-Integration Theory, the form information would lack meaning by virtue of it having limited relationships with other information.

Because it is the case that poor visual form discrimination alone is not sufficient evidence for defective form analyzers, one questions what evidence would be necessary to conclude that the child had defective form analyzers.

There are two answers to this question, neither of which are entirely satisfactory. The first is that a single measure of defective form analyzers would need to be a direct neurological assessment of the analyzers' ability to output information when stimulated. While measurement of this type is theoretically possible and, in fact, accomplished through the chronic implant of electrodes in laboratory animals, such methods are not possible with humans. Thus, while a single direct measure of analyzer functioning is feasible, we await development of our present technology to devise a single, direct measure of analyzer firing.

The second answer to the question as to how one might assess the presence of defective analyzers transmitting form information to the array would be to examine the total pattern of disability to ascertain whether it has the following characteristics: first, the disability resulting would be a very pervasive one, extending beyond the classroom into all aspects of the child's life. After all, the human is constantly called upon to make discriminations based on form, living in an environment populated with various objects. Even though reading may place extreme demands on our ability to discriminate form, it somehow seems reasonable that basic structural problems in the form analyzing mechanisms would be disturbing enough to show themselves in the child's everyday behavior. For example, the poor visual form information would prohibit adequate visual-kinesthetic integration resulting in the child appearing clumsy and having little interest in most visual-motor sports such as baseball and little interest in visual-motor activities such as drawing and writing. The everyday processing of information in the environment about form would be difficult; aside from appearing clumsy, the child might also misjudge distances and bump into objects as though he had a visual acuity problem. Entertainment devices such as television and movies would have reduced interest for the child and in extreme cases would be experienced as confusing and upsetting.

A second major characteristic of children with defective form analyzers would be their slow but regular acquisition of information about form. Once the form characteristics had been learned, the child could be expected to retain that knowledge for recognition at a later time. This pattern can be distinguished from problems where apparent gains are continually lost and have to be re-established, a pattern likely caused by faulty selection of intact analyzer data whereby learning at one point in time with the appropriate information on the array may not be evidenced at some later point due to the child's failure to reduce the proportion of task-irrelevant information on the array. Hence, when the selection of appropriate information is the problem, the behavior will look much more erratic where in the case of defective analyzers, once a correct response has been learned to the analyzer data even though these data are fragmentary, it should be maintained. Any alteration in the format of the material to be learned which would accentuate form characteristics giving the defective system as much opportunity as possible to transmit information about form, should aid the child in performing at a more satisfactory level.

With the assessment of defective form analyzers so difficult, it is nearly impossible to estimate what the incidence of such a problem might be. My guess would be that it is very low. Certainly, perceptual motor tests like the Bender Gestalt Test and the Benton Visual Retention Test would find such a child performing extremely poorly. Thus, the population of children afflicted with defective form analyzers would need be a subset of those learning disabled children found to be deficient on visual motor tasks. Further, as noted above, the disability should be sufficiently great to be noticed in other aspects of the child's life. Typically, children are not found to have difficulty on visual motor tasks until after they have done poorly at school, no one suspecting they were having difficulty in form discrimination until the more exacting demands of school were upon them. Though only an intuitive guess, I surmise that problems with defective analyzers would more likely be noticed prior to the child's failing at school. This small group that is left may constitute what we now see as the child with a very severe perceptual-motor handicap.

Irregular signal life of visual information. Neural activity transduced at the receptors from physical energy has a characteristic signal life. Within the visual system, it has been shown that neural activity carrying information about form is available for as long as a second after termination of the external stimulus (Sperling, 1960). The persistence of the neural activity after the offset of the initiating stimulus is typically referred to as iconic memory within the visual sphere (Neisser, 1966).

The persistence of the neural activity after the offset of the eliciting cue would reasonably serve the function of providing the organism with visual information while the eye moves to register new input. It is generally thought that little or no information is gathered by the eye during saccadic movements but that a series of more discrete "snapshots" provides the visual information for the organism. Consequently, one could consider the difficulties encountered were the signal life of the output from the analyzers responsible for form either too brief to span the time period between saccadic movements or conversely too persistent to surrender its space on the informational array to information gathered by the subsequent eye fixation.

In the case where the signal life were too brief, the problem for the child would be that he would have insufficient time to integrate the visual form pattern with the phonemic equivalent on the coded array. By the time he were able to produce the corresponding phonemic representation for the graphemes on the array, the grapheme representation would have faded making integration with the phoneme on the coded portion of the array less efficient. Consequently, reading acquisition would proceed very slowly, the child having to cover the same graphic elements repeatedly until the integration leading to understanding of the graphemes could be accomplished.

The learning process should be progressive, the child's performance accurate though tediously slow. Complicating the slow acquisition process, however, would be motivational factors as the child would actually be engaging in a task significantly more difficult than that for a child not so afflicted. Further, because visual information historically would not have been readily utilized by the child, it would have already been relegated to a low position on his information-selection hierarchy. By the time the child begins reading in school, he may already have learned to favor input from auditory, kinesthetic, or mentation sources rather than that from the visual system. Low preference for visual information has a progressive deleterious effect resulting from reduced practice at forming the visual-mentation channel necessary for reading. The lack of practice would be particularly detrimental in that the brief signal life of the form information on the uncoded portion of the array would constantly make the array susceptible to being overtaken by task-irrelevant information. As the visual information fades, the array inherently becomes more sensitive to new input. Unless the child is able to maintain both his gaze on the material to be read and the inhibition necessary to preserve the visual-mentation channel, he will be particularly susceptible to distraction. As noted, the distraction probability is increased by the visual material to be learned being low in the child's information selection hierarchy and auditory material or extraneous mentation, which within the reading context is task-irrelevant, being high in the hierarchy.

The signal life of the visual form information may conversely be too long, resulting in it being confused with that from subsequent eye fixations. The problem that would be created would be similar to that sometimes experienced by children with eidetic imagery capabilities. These children can preserve a visual image for many seconds (Haber, 1964) and frequently need to blink or shake their heads in order to disrupt the persisting image. Within the context of the Information-Integration Theory, eidetic imagery is a productive capability of nonverbal imagery on the coded portion of the informational array rather than a persistence of the visual analyzer data on the uncoded portion of the array. Though the neural activity would be viewed as occupying different portions of the informational array, the problems encountered might be similar though less intense in this latter case. Specifically, persisting information from a previous eye fixation could have sufficient signal strength to confuse the pattern of neural activity on the informational array evoked by the following fixation by blending with it. It is highly speculative that extended signal life can be a problem. It is entirely possible that even the longest signal life would not create problems for new input entering the array which would have by virtue of its recency much greater strength. This question is an empirical one deserving of study.

The contention that length of signal life for visual form information is positively related to academic skills could most readily be investigated on an adult population. Sperling (1960) has described the procedure by which the persistence of the visual information can be assessed following the offset of the physical stimulus. The simple procedure involves a tachistoscopic presentation of a matrix of letters larger than the subject is capable of recalling totally. He is signaled after the stimulus has terminated whether he is to recall the top, middle or bottom row of letters. The number of letters correctly recalled in this partial report procedure is used to estimate the amount of the material available to the subject at the time he was signaled. This simple procedure is suitable for the examination of young children, thus enabling a rather simple and direct test of the issue of whether the disabled reader has an irregularly short or long signal life for visual form information.

Inadequate channel formation due to ineffective inhibition. It is critically important for reading that the child be able to inhibit a large portion of his potential stimulus environment and select for his informational array a combination of carefully modulated visual information and its phonemic equivalent produced through mentation. The mechanism responsible for the channel formation is the inhibition process which is thought to (1) utilize energy from the arousal system, and (2) develop efficiency through repeated practice of inhibiting various combinations of events. The primary cause for malfunction in the inhibition process would be an irregularity in the level of arousal afforded the process. Either insufficient or excessive amounts of arousal would prove detrimental to the inhibition process. Only one of these conditions, that of insufficient arousal, would theoretically produce the kind of behavior that would fall within the domain of learning disabilities. The other condition where arousal is excessive would result in a symptom pattern resembling infantile autism, according to the Information-Integration Theory. Excessive arousal would create a condition of extreme inhibition which the immature organism would not yet be capable of deploying appropriately. Consequently, inhibition would be directed summarily at large segments of input resulting in the organism establishing and maintaining very narrow channels. Due to the great amount of inhibition, distractability would be very low. Integration, requiring the simultaneous processing of two or more inputs, would be minimal, and the resulting experiences, in being drawn from a single or restricted set of input sources, would have little acquired meaning. I include this very brief sketch only for completeness and now continue to the case where inhibition is insufficient due to inadequate levels of arousal.

Lowered arousal results in a failure of inhibition to hold unwanted material off of the informational array. The extreme case, though hypothetical, illustrates the problem inadequate inhibition creates. With no inhibition at all, entrance of information onto the array would be governed by the type and intensity of stimulation in the environment, the organism's selection hierarchy, and satiation. The organism essentially would be at the mercy of stimulus variation, any signal that differed significantly from those on the array being able to constitute a new channel according to the signal detection model described previously. Without inhibition, the level of informational analysis would be restricted to that dimension which caused the source to be processed in the first place. Lacking complexity, the information would quickly satiate making the array once again maximally susceptible to new input. In short, the organism would become "stimulus bound", drawn about by changes in his environment.

While inhibition would never be totally absent, a less than normal amount of arousal could still be highly detrimental to educational tasks requiring precise information selection. The clinical picture observed would be one of a child who in present-day lingo is incapable of "getting into anything", of being equially interested in everything but not really interested in anything. One would see a child who is always on the move, stimulated by each strong stimulus in the environment but who in a stimulus-free (or reduced) situation would emit very little activity. The child would be initially attracted to an object only to put it down within seconds. Though initially interested, that interest would appear superficial and easily satisfied. These characteristics are typically among those attributed to children called "hyperkinetic" or "hyperactive."

The lack of sufficient inhibition and practice at its deployment allow for constant intrusion of external stimulation onto the informational array. With the informational array controlled more by strong external stimuli and strong bodily states than by mentation on the coded portion of the array, the child's motoric and mental behavior will be totally affected. First, his behavior will lack direction. Direction comes from the continuity of cues present on the coded portion of the stimulus array; recall that one's own thoughts and symbolic conceptualizations of immediate goals form a portion of one's cue base. It is the presence of this cue base to which we give over some of our array capacity that allows us to return to our work after being interrupted. The child with inadequate inhibition, being continually disrupted from any "train of thought" (coded array data), will appear to act in non-purposive ways. Purposiveness may not even be evidenced when the child is placed in a more restricted, stimulus free environment because input from mentation will be low in the child's information-selection hierarchy.

The second major effect of insufficient inhibiton derived from the first; the lack of direction caused by the child's behavior being dictated by strong stimuli will result in the storage of atypical experiences. Much of his experience will be of single modality events, strong noises, bright colors, unintegrated with events from other input sources. Experience will be terribly disjointed such that the child's train of associations will be affected; thought will be limited in amount and associations to spoken or written verbal material will be primitive, atypical, and few.

Not being heavily directed by information on the coded portion of his array, the child further will be unable to maintain a set. Recall that sets to respond in a certain way are predicted on coded array usage. The person readies himself for a coming event by drawing from thought a representation of what is to be expected and entering it as a neural pattern on the coded portion of his informational array. The child without sufficient arousal loses in preparatory tasks both the value of increased inhibition and that of coded array facilitation of raw data interpretation.

Limited use of the coded array abdicates the longer signal life advantage coded material has over uncoded. In addition, the coded array rehearsal mechanism is not utilized fully. Consequently, those tasks which require active rehearsal so that traces reaching the coded portion of the array are maintained will be performed very poorly by children with insufficient arousal.

Tasks which require not only rehearsal but even simple decisions will take longer by virtue of the coded array being interfered with by new input from the senses or other bodily sources. More specifically, the pattern of behavior would appear more variable than the normal child's with some decisions being performed very rapidly and correctly with others being performed slowly, having been interrupted by the neural representation of some irrelevant event entering the array.

The neural activity which flows from the array (motor and mental activity) will be relatively undifferentiated because the level of information commanding array space is so superficial. Only through integration, by allowing neural activity from two or more sources simultaneously onto the informational array, can motor or mental activity become more refined. Initially, one's reaction to external events is gross, the infant startle reaction perhaps being prototypic of the strong motor reaction to supra-criterion external sensory stimulation. Because the organism makes discrete motoric activity, kinesthetic feedback is assured and the possibility that the neural representation of external stimuli will become integrated with the information about one's own position in space is this assured. In time, the motor response and its attendant kinesthetic feedback become more integrated with the specific external cue. For example, a child unfamiliar with playing catch with a ball would react differently if surprised by a ball being thrown toward him than would an experienced child. Where the first might exhibit a response more closely associated with a startle reaction, the second's motor response would be more refined and adaptive likely involving reaching toward the ball.

This example of motor behavior illustrates the general process by which the neural activity which flows from the informational array is continually shaped by the integration process. With repeated trials, the repetitive aspects of the neural pattern on the array come to evoke the post-array neural activity. For the child with a history of limited coded array usage, mentation flowing from the informational array will similarly be unrefined and somewhat typical because the informational array's coded portion has not sufficiently often entertained the neural activity representing thoughts and nonverbal ideation and, hence, integration within the ideational system will be underdeveloped. Consequently, these children will have fewer and more atypical associations on word association tests which may constitute a very simple procedure evaluating many of the foregoing assertions about this type of child's thought processes.

Visual information low in selection hierarchy. A common problem caused by a variety of difficulties results when the visual information necessary for reading is low in the child's information selection hierarchy. It is not sufficient to admonish the child to "pay attention to" the relevant material; it is very possible that he may not be capable or at least not be practiced at such an information extraction task. We have already touched on two reasons why the visual form information would not be a highly probable set of data for the array to select. The first was that the analyzers responsible for form information might be defective. The second was that the signal life of the output from the form analyzers might be irregular. A variety of other conditions could also result in the visual information being of low priority for the child, and hence, cause him difficulty in reading. Without attempting an exhaustive listing of those conditions, I would like in this brief section the describe what the nature of this problem is for the beginning reader.

Visual form information being low in the subject's selection hierarchy is a statement not only of information reception priorities but also of distraction likelihood. Distraction is really no different from selection of information, distraction simply being the selection of information which is defined as task-irrelevant. Consequently, a child who has a high probability of selecting auditory information for processing will appear highly distractable in a reading task where processing visual information is required. In reading, one need extract in an extremely discriminative fashion, information about form; consequently, a large portion of the informational array need be cleared sufficiently to represent this information. Inhibition need be directed at the potentially disruptive input such that the difference between the strength of the data on the array and that of potentially disruptive input (d') will be reduced. Further, the criteria specifying the magnitude of d' required to constitute a new channel around distractor sources need be raised such that even when a distractor does break through the inhibition the child will suffer only a brief interruption of the reading task and will not process the distracting information further.

While the information selection hierarchy is flexible, responding to the demands of different tasks, it is not infinitely so. The degree of flexibility is determined in large part by the system's structural capabilities, especially the integrity of the form analyzers in the case of reading, and by the organism's history of information processing, especially with respect to practice in establishing channels and the accompanying deployment of inhibition. A child who for one reason or another has come to prefer information arriving auditorily or through some other mode than visual will become increasingly less practiced at processing visual information, particularly whereas the information he would prefer is usually present but task-irrelevant. "Paying attention to" (continued processing of) visual information is a learned skill, the failure at which signifies not the child's stubborn intractibility but the working of his peculiar capabilities.

According to the progenerative hypothesis, information which does not stimulate further neural activity becomes less likely to be selected in the future. Thus, if for whatever reason visual information becomes less selected by the child, his inability to process visual information efficiently will be progressive. While in less severe cases the capability of processing visual information may still be acceptable, its failure to be used as often or in a preferential manner continues to encourage distractibility from the more preferred channels, likely to lie within the auditory or kinesthetic modalities or ideation. In more extreme cases of decreased preference for visual form information, the ability to make form discriminations will be hampered as well. The meaning of any neural pattern on the informational array aroused by form characteristics in the environment is determined by the character of post-array neural activity evoked. Thus, for a symbol to have meaning, it must be recognized (discriminated) as a unique pattern and integrated with the neural representation of other events which already have meaning. In the case of reading it is likely that the auditory and kinesthetic systems are the most critical in providing the meaning with which the graphic symbols will become integrated.

Of these two sources of integration for the visual forms (graphic symbols), kinesthetic is the more basic developmentally and must be well integrated before the child enters school. Even the most basic knowledge about the visual environment such as the notions of "left and "right" must be determined with reference to the child's own body. Hence, the visual information needs to be integrated with the kinesthetic information if the child is to interpret his visual world correctly. In a similar fashion, the meaning of the pattern of neural activity on the informational array associated with various lines, curves and directionality needs to be integrated with the kinesthetic and other cues which inform the child about his own bodily position, if a unique and consistent response is ever to flow from each unique grapheme.

Perceptual learning is integrationally based and derived from experience with the visual environment. Studies using infra-human subjects have shown that the mere experience of having visual forms present in one's rearing cage will increase discrimination performance using these items as discriminanda (Gibson & Walk, 1956). Further, research in the Witkin tradition (e.g., 1965), has shown that the cognitive style of field dependence is related to poorer pattern recognition (Kaswan, Haralson, & Cline, 1965). Consequently, a person characterized by extreme field dependence, seldom using his own bodily cues to understand his orientation in space, would be expected to have difficulty integrating the visual information with the kinesthetic information provided by his own body. Hence, such a person would have greater difficulty in form discrimination (pattern recognition) and, hence, greater difficulty in reading. Data supporting this line of reasoning show that many learning disabled children are heavily field dependent (cf., Keogh, in press; Keogh & Dolan, 1972). From these data, the deduction is possible that field dependent persons in general will be poorer than their field independent counterparts at kinesthetic and tactile discrimination and in visual-kinesthetic and visual-tactile integration tasks.

I have not yet mentioned any additional reasons why visual form information would be low in the child's selection hierarchy. In an ensuing section I describe why, according to the progenerative hypothesis, the child less capable of having visual information on the array stimulate post array neural activity in the imaginal system will decrease his preference for that visual information. This explanation for visual form data being low in the selection hierarchy like the defective analyzer and irregular signal life explanations posits specific defects in the child's information processing system. It is also possible that an initially intact organism could come to have visual information low in his selection hierarchy through the sole workings of experiential variables.

For meaning to be attached to the neural pattern of information representing objects in the environment, these patterns need be integrated with other information which already has meaning. Visual information could fail to acquire sufficient meaning for the infant if he is unable to integrate it with data from other sources. Sight of the human caretaker may provide critically important initial visual data which can acquire meaning through their association with other information the infant experiences. For example, the visual information of the human face is consistently correlated with the cues of hunger and their satisfaction and with the tactile and kinesthetic cues resulting from being picked up and carried. Thus, as the research growing out of Spitz's work (e.g., Spitz & Wolf, 1946) has shown, the human face may serve a catalytic function for the visual sphere similar to that which the reflex system provides for the kinesthetic sphere. Both yield strong and consistent cues which provide an initial basis for integration, thereby catalyzing the integrational process of perceptual development.

The deleterious effects on institutionalized children denied the extensive interaction with the caretaking adult is well known (Ribble, 1944). This condition may represent the extreme of a problem experienced by reading disabled children whereby through some unfortunate circumstances their early visual experience may not have been appropriate to establish sufficient meaning (post array neural activity) for visually input information. Consequently, other cues may have become more informative and early in the child's life led to a relative disuse of the visual system. Any support for such a contention would certainly argue strongly for early childhood education.

In addition to the characteristics already described in this section, the child having visual form information low in his selection hierarchy would experience problems not only in reading or in manipulating graphic symbols but should also manifest problems in non-symbolic form analysis. Thus, he should resemble the child thought to have defective analyzers, the problem being a pervasive one not limited solely to schoolwork. The pervasiveness of the disorder is important because the Information-Integration Theory also predicts that inadequate stimulation of the imaginal system by visual graphic input will also interfere with reading but that in this later case, discussed more fully below, only preference for symbolic material should be low in the information selection hierarchy.

Failure to Produce Information

According to the Information-Integration Theory, production of the phonetic equivalent of graphic signals is necessary for the acquisition of initial reading. The child must be active and capable of drawing upon his thought processes to produce the neural pattern representing the phonemic equivalent of the grapheme.

Production as a general problem. Just as visual form information can represent an inadequately low input in the information selection hierarchy, so too can the selection of one's own thoughts be insufficiently dominant in the selection hierarchy. With many possible inputs to the informational array, all vie for the same informational capacity. Where one child may be relatively ignoring of visual information, another may be equally ignoring of information potentially suppliable from his own long term storage. Such a child will have difficulty in reading because reading requires an active production of the speech sound equivalent on the coded portion of the informational array. The integration process through which the neural pattern representing the visual grapheme acquires meaning is limited by the child's capability of producing the neural representation of the phoneme which already has meaning accruing to it.

A child with a general productive problem should be readily recognized. He will appear quiet, exhibiting little productive speech. He will be poor at relating his own past experience and be deficient at activites involving "show and tell" type procedures. Though the child may be a persistent worker, he will need to have carefully planned materials to guide his progress as he will not sufficiently utilize thought entered onto the coded portion of his informational array as an internal guide. His relative disuse of the imaginal system will make him appear rather uninteresting and ungifted. He will probably do more poorly on individually administered intelligence tests which typically involve considerable verbal-expressive skills but will do exceedingly better on non-verbal intelligence tests such as the Peabody Picture Vocabulary Test.

Disuse of the coded portion of the array normally supplied quite heavily by the imaginal system will result in the child being deficient on tasks which require rehearsal. Rehearsal is a function of the coded informational array whereby the productive use of thought is capable of regenerating an item on the coded portion of the array, thus extending its useful life. Failure to use this reproductive capability can prove detrimental on a wide variety of school tasks.

One additional characteristic which results from a failure to use the coded portion of the array as one's cue base as opposed to reacting to the raw uncoded input is a relative inability to engage in inactive behavior. At the extreme, the child will have difficulty making the appropriate movements to signify hammering a nail, buttering bread, and so forth because these motoric behaviors for him are evoked by the neural representations of the objects themselves and the tactile-kinesthetic cues on the uncoded array and not by neural activity on the coded array standing for the object, i.e., the object's name. The extreme of this condition is expressive aphasia which suggests that aphasia is also to be explained in terms of the relative disuse of language as an internal cue base for behavior. Further, Sigel (cf., Rowland & McGuire, 1971, Ch. 7) has noted that many Black children have particular difficulty with categorization when pictorial stimuli rather than actual objects are used. Once thought to be a conceptual problem the children were experiencing, Sigel has reinterpreted these data stressing that the "representational mode" is an important dimension underlying intelligent behavior. Having the actual objects present provides the child the cue base which he typically uses for generating further motor and imaginal behavior whereas the pictures represent an abstracted, diminished set of cues only sufficient if one first codes the object and uses this coded representation as the cue base for the further mental and motoric activity. The extensive training middle class children receive from their parents may be important in establishing the coded portion of the informational array as the more relevant cue base for the child and, hence, establish the thought system as high in his information selection hierarchy.

Relative disuse of the thought channel will have cumulative effects. Elaboration of the meaning of words and events is greatly enhanced by the integration of one word with another through their near simultaneous airing on the coded portion of the informational array and by the integration of words and thoughts with new sensory events through their simultaneous occurrence on the coded and uncoded portions of the array respectively. Paucity of imaginal activity on the coded portion of the array restricts the number of opportunitites the child has to form more complex thoughts and hence his associations to words will be simple, typical and sparse. The association pattern is somewhat different than that of the child whose information processing is hampered by insufficient arousal. This latter child's associations are atypical, reflecting his irregular stimulus-bound processing.

In brief, we have a picture here of a child who has limited verbal capabilities though he may appear attentive and responsive to his environment. He needs assistance in directing his activities and will do poorly whenever tasks requiring rehearsal or expressive or enactive behavior are called for. He will not be a particularly interesting child, his mental activity being very simple and typical, though he may be pleasant and interpersonally attentive and dependent.

Specific input irregularities and inadequate integration. Two more circumscribed disabilities involve malfunctioning of the productive use of thought: one is simply a more refined subset of the disorder immediately above, that being the specific inability to form as an informational channel the visual and mentation sources required for reading. This special case recognizes the possibility that the formation of the visual-mentation channel itself may be deficient despite the intactness of visual processing and of the productive use of thought.

The major sharing of one's information-processing resources between two or more sources simultaneously represents a developmental achievement. Whereas the integration of two inputs on the uncoded portion of the informational array may be the most basic integrational activity, exemplified by one's knowing an object via either sight or sound, forming a channel between coded and uncoded inputs for integration may be significantly more difficult. There is even the possibility that the former task, integration of two sensory inputs, may be aided by analyzers specifically designed to register multimodal stimuli, that is by cells which fire when either an auditory or a visual cue is registered. Consequently, though productive speech and visual processing may be intact, the necessary joint channel between the two could be inadequate. Flexibility in utilizing one's array can be as important as array size (capacity).

This kind of cognitive disorder postulated must be recognized as entirely speculative in nature. There is to my knowledge no research on this type of integration problem where thought and sensory input need be joined to arrive at a satisfactory understanding. Typically, integration problems that have been studied involve two sensory signals and even this research is in its infancy. However, the deduction from the Information-Integration Theory that such an integrational task is involved in reading acquisition would lead us to examine such integrational tasks in detail. It would be a relatively simple matter to construct testing procedures to assess the ability to deal simultaneously with information produced by the subject and that provided by the visual channel.

A second circumscribed difficulty some learning disabled children may encounter involves the specific inability to produce the phonemic equivalent of the grapheme being viewed. Rather than a generalized productive disorder, this problem involves the specific inability to form the necessary neural patterns on the coded portion of the informational array which if voiced would represent the phonemes corresponding to the graphemes veing viewed. Such a disorder is probably quite common because it is based in an inability to form the necessary auditory discrimination between phonemes. While it is possible for one to discriminate speech sounds without being able to reproduce them on the coded portion of the informational array, i.e., an articulatory disorder, it is more likely that the inability to reproduce speech sounds accurately derives from the inability to discriminate those sounds in the first place.

Though I know of no specific epidemiological evidence, it is my experience that auditory discrimination problems are quite frequent among learning disabled children. It has not ever been well understood why difficulty within the auditory sphere should interfere with reading acquisition. Such is obvious though within the present theory for the child must produce the phonemic equivalent on the coded array to integrate with the grapheme on the uncoded array for successful reading acquisition to occur. An inability to discriminate the relevant speech sounds and a resulting inability to reproduce them either vocally or "silently' on the coded portion of the informational array would necessarily hamper the integration process by not providing the necessary phonemic equivalent and the meaning which flows from it.

There is a general symmetry between the visual discrimination problems and those in the auditory sphere, failure in early integrational development being implicated. However, there are two main characteristics which make auditory discrimination problems different from visual ones: the first is that in reading acquisition the meaning derives from the auditory cue and must be integrated with the visual one. Hence, failure in auditory discrimination produces a more pervasive educational problem where failure in visual discrimination may be more limited to reading and related tasks. Second, auditory discrimination problems may derive not solely from inadequate processing of the auditory analyzer data but also from the interference of previous learning. Possessing a proper set of speech sound discriminations may not be sufficient and may even be interfering if a different dialect is utilized in the classroom. Even, though a child may be capable of discriminating and producing the speech sounds within his own dialect, accomplishing this task for a slightly different dialect, often that of the predominant middle class culture, may give him particular problems.

Because of the subtle differences that exist between the phonemes he is taught to associate with the graphic symbols and those he has learned in the past which give rise to his ideational activity, he may be unable to accomplish the reading task efficiently. The phoneme as pronounced in one's own dialect versus the pronunciation of the teacher may be just different enough such that the meaning which flows naturally from the child's own internal production of the phoneme as he knows it is not so evoked by the phoneme he is being taught in school to associate with the grapheme he reads. Thus, he is trying to integrate two new sources of information, the grapheme visually presented and a phoneme he is encouraged to produce, neither of which have sufficient meaning for him. Hence, the reading process proceeds very slowly, progress being made only to the degree that the phoneme system of the child and that being used in the classroom overlap or to the degree that the phoneme system of the classroom can come to acquire meaning for the child.

Informational Array's Failure to Evoke Imaginal Activity

If information from a particular source is to be processed continually, it must stimulate post-information array neural activity. This activity may either be motoric or imaginal or both but some activity must flow from the information on the array for the probability that that source of information will be selected in the future to hold constant or increase (the progenerative hypothesis).

There are four distinct processing difficulties which can occur: (1) Does semantic input whether auditory or visual sufficiently stimulate imaginal activity (thought and imagery)? (2) Does visual form data efficiently evoke its coded array equivalent? (3) Does visual form information, though capable of evoking the coded equivalent, sufficiently come to evoke directly the imaginal activity? (4) Does the auditory input require substantial recoding in order for imaginal activity to be elicited? It is the failure to stimulate the imaginal activity, which through the progenerative mechanism makes reading more difficult by lowering the likelihood that the appropriate information will be selected for analysis in the future, that is basic to each problem.

Uncoded information to imaginal system defect. A pervasive problem would result if language symbols whether presented visually or auditorily did not readily evoke the neural activity representing the meaning and associations of words. Though the thought system itself may appear intact, i.e., the coded array, imaginal activity that flows from it, and feedback from the imaginal system, the linkage between the uncoded input and imaginal system might be defective. The result would be a generalized receptive language problem.

This type of difficulty, though uncommon in the extreme, might characterize to a lesser degree many learning disabled children. The problem is one in which language symbols do not evoke sufficiently the richness of meaning and associations of which the child is capable. Whereas only the symbolic, especially linguistic, functions are involved here, the child would appear otherwise intact; he would be well-coordinated, motorically and emotionally expressive, and at least of average capability. However, his difficulty in receptive language would limit his approach toward language and experiences with it and hence he would appear concrete and narrow in his thinking. Such a child would do well in early school activities requiring manual and social skills but would have increasing difficulty as more and more demands were placed upon symbolic capabilities.

Visual uncoded array to coded array deficit. A second problem in reading acquisition would result were the productive part of the integration process not to give way to the more automatic flow of the auditory equivalent (coded array) from the visual input. Initially, the integration process requires production by the child of the phonemic equivalent as the grapheme is viewed. Eventually, the coded portion produced by the child comes to flow from the grapheme being viewed. Thus, the phonemic equivalent on the coded array comes to act more like a response to the grapheme than a production by the child.

This integration procedure resembles classical conditioning which in turn may represent a special case of the integration process. At the stage of information processing in question, the visually received information on the uncoded portion of the informational array serves as a conditioned stimulus while the phonemic equivalent of the word produced initially by the child acts like an unconditioned stimulus. The meaning of the word and the associations to it act analogously to the unconditioned response. The integration process should result in the visual grapheme evoking the meaning and associations initially evoked only by the phoneme. Unlike classical conditioning theory, it is assumed that in the early stages of this process, the coded array equivalent (phoneme) comes to be evoked by the visual grapheme, thus mediating the meaning and associations. With repeated practice, this intervening step is eliminated. The deficit posited here is a failure in the early stages of integration whereby the coded array representation does not come "naturally" to follow from the grapheme but must continually be produced by the child.

Uncoded visual array to imaginal system defect. One eventually wishes to have the visual material evoke meaning directly without requiring the mediation of the phonemic equivalent on the coded array. Such efficiency likely characterizes only the reading of highly practiced words. Likely, adult reading is a combination of meaning flowing directly from the visual symbols and that requiring the mediation of the phonemic code, either flowing directly from the grapheme or produced by the reader in the case of unfamiliar or unpracticed words.

Failure of the reader to be able to drop out the coded array "response" and have meaning flow directly from the visual material, thus making reading more efficient, would constitute a specialized type of learning disability. Though initial reading acquisition might proceed satisfactorily for such a child, his later reading would be hampered by his being required to go through the slower and more tedious productive process even on highly familiar words. This immature type of reading is very time consuming and effortful and produces less imaginal activity relative to the amount of information processing necessary. Therefore, according to the progenerative hypothesis, the probability that the necessary information for reading would be sought would decrease. Failure to have meaning flow directly from the visual graphemes makes reading a more difficult task, requiring more array space to generate the same amount of imaginal activity. The progenerative hypothesis implicitly assumes that the reinforcing effects of imaginal activity are proportional to the processing effort (array space) required to stimulate the neural activity. Even though an immature reader is capable of deriving meaning from words, he will be less likely to choose reading as an activity if the meaning derived is very expensive in terms of processing effort.

Dialect problems. Typically, the pattern of neural activity representing phonemes on the coded array contains that information which is the child's idiosyncratic understanding of the relevant dimensions of his spoken language. This representation is likely mirrored by the child's speech, barring expressive problems. The child can most easily understand someone with a dialect similar to his own as the raw input on the uncoded array will be highly similar to that which he can produce himself and that from which his ideational and motoric activity flows. The portion of the neural pattern aroused by the unique aspects of another's speech, e.g., voice tone, do not obscure the shared aspects which the developing organism learns to process selectively.

Special problems occur when the internal code which gives rise to meaning does not correspond sufficiently with the speech sounds with which the child must deal. While we recognize intuitively this to be a problem when different languages are involved, we tend to ignore the importance of the problems created when the child must understand one speaking in a dialect somewhat different from his own. Within the context of the Information-Integration Theory, the neural activity which would represent the child's equivalent of a phoneme would be seen as significantly different from the neural activity aroused by the teacher speaking that phoneme. Hence, an integration task must be undertaken whereby the teacher's utterance on the uncoded portion of the informational array needs be integrated with the child's internally produced phoneme so that meaning can flow from the teacher's utterance. Essentially, the same formal requirement necessary to derive meaning from graphic symbols (reading) apply to understanding the teacher's speech, the major difference being that the overlap between the teacher's speech and the child's internally produced speech will be greater than between written speech and the child's internally produced speech.

If the child is taught to associate the sounds in the teacher's dialect with the graphic symbols prior to his integrating these language sounds with his own, the discrepancy between the teacher's dialect and his own as internally represented on his coded array will cause a decrement in the amount of meaning which flows from the word once sounded. For the written word to evoke in him the full meaning the child has stored for it, the graphic word must be integrated with the neural pattern of the phonemes of the child's dialect not that of the teacher. Consequently, either the child need be taught to read in his own dialect using the phonemes of that language system or he must first tackle the additional integration problem of relating his dialect to the teacher's and then the teacher's dialect to the graphemes. The child whose teacher speaks the same dialect as his, does not face such a "language barrier".

The kind of disability which would result from dialect problems would be situational, limited to those instances where meaning is conveyed in the foreign dialect. Unfortunately, these situations frequently involve all of schooling for some children and hence the child's formal education becomes in jeopardy. While the child would appear imaginative and expressive at home and with peers, in the school setting he will appear dull, unexpressive, and bored. The failure of the teacher and subsequently of the graphic materials to access the child's imaginal processes will cause him to become uninterested and inattentive in school. Unless some integration training is adopted or the child has continued massive experience with the dialect spoken in his school so the integration of his language system with that of the teacher can occur, he will not be able to access his everyday experience and rich imaginal activity using the teacher's dialect or graphic symbols. The child will continue to suffer within the school context by not having the spoken or written language activate the stored meanings and associations which constitute the richness of his experience.

Task Irrelevant Array Content.

The disabilities we have been considering involve structural or functional irregularities in the information processing and integrating system. Failure at educational tasks such as reading acquisition can also derive from two other sources, one involving interference from task-irrelevant content on the array, the second involving the processing complications resulting from anxiety.

Task-irrelevant content. The content issue was previously introduced when considering the information selection hierarchy. There the emphasis was on the "negative preference" for a given data source due to its inability to transmit information or stimulate further neural activity in either the motor or imaginal systems. Failure to entertain on one's informational array the data appropriate to educational tasks can also derive from competition by other content which within the educational context would be defined as task-irrelevant. It is certainly reasonable that within the educational situation, information is available to the child which has greater interest for him than does the educational task at hand. If the intrinsic value of working on the educational task is not as great as working on some other and if extrinsic rewards do not reverse this balance, the child will engage in the extra-school activity.

These extra-school activities can be many and diverse involving information from many different sources. Perhaps the most typical is drawing upon one's own mentation as an information source. Frequently given the pejorative name "day dreaming", this mental activity is likely more important to the child than the educational task at hand. One need explain without invoking invective constructs why he engages in such task-irrelevant behavior. Though it appears circular to claim that he prefers his own thought processes to the educational task at hand, the Information-Integration Theory predicts that the amount of mental activity stimulated by the channel he is processing is greater than that stimulated by the educational task. This empirical assertion can be validated or falsified: A most simple test would involve assessing the degree of distractibility as the child engages in reading versus "day dreaming". The Theory would predict that distracting the child from reading could be accomplished by a less intense signal than that required to distract him from day dreaming, indicating that the latter task more completely fills the array and stimulates post-array mental activity.

The breadth of information found to interfere with the educational task will depend on the interest with which the educational task is held. The child extremely bored by an educational task either because of one of the previously listed disabilities or perhaps because the material is being so poorly presented by the teacher, may turn to processing whatever "catches his eye". He need not remain passive but can create situations which will provide him with some opportunity for post-array stimulation, as for example, by passing notes, teasing, or otherwise interacting with other pupils.

The cases of competing content described thus far are occasioned by an extremely low preference for the educational material. Not all cases of competing content require that the educational task be held in such low esteem. Concerns at home such as his relationship with his parents or concern about his parents' relationship and, in general, the whole host of emotionally-laden conflicts to which children are susceptible can come to compete with the school task.

Besides the strictly educational tasks, the school provides a setting for the learning of a wide variety of developmental skills. These include working out peer relationships with the same and opposite sex, forming relationships with adults, evolving one's self concept, and expanding one's cognitive abilities. The importance of these problems in the child's life makes it seem inappropriate to refer to them as task-irrelevant. However, in the classroom situation, these concerns can all at times compete for array space with the information from the educational task at hand.

What is critical in determining whether "emotional problems" of the child will interfere with schoolwork is their degree of trans-situationality; a pervasive problem will be cued by a wide variety of events and consequently often gain entrance onto the informational array. Because emotional problems frequently have an associated bodily state such as increased muscular tension, gastro-intestinal distress, elevated heart rate, and the like, these states can come to stimulate the cognitive component of the problem. The cues from these bodily states are costly of array space to process and costly of energy to inhibit. As the bodily state is a part of the child, these cues are maximally trans-situational, constantly reminding the child of his problems. The child's concerns are typically not so easily scheduled as are the classes in a school day. When seated in his reading group, the child may be more concerned about his peer status than about the content of his beginning reader. The fact is that the teacher must compete for the child's attention, i.e., for space on his informational array. To be at all successful requires open access to the child's informational array attained by providing him with activities which stimulate his imaginal system.

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APPENDIX L

THE APPLICATION OF BAYES' THEOREM TO CLINICAL IDENTIFICATION OF LEARNING DISABILITIES*

by

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INTRODUCTION

At the present time, there is no one procedure which accurately allows us to identify the existence of all learning disabilities. Instead, clinicians are using a number of tests along with diagnostic judgment. In most clinical situations, the time and money expended on the analysis of referred cases is well spent. However, clinical diagnosis presents problems when it becomes necessary to screen a large number of referrals for public school services. These problems relate to economics (clinical diagnosis is expensive), to personnel (there are not enough clinicians to do the job), and to administrative implementation (there is no economical and efficient procedure for screening).

These problems may be alleviated by analyzing clinical diagnosis in such a way that identification of learning disabilities can be separated from the more intensive diagnosis of deficits. Such a division of clinical diagnosis is suggested as follows: (1) subjective judgment for identification of learning disabilities leading to placement in the special learning disability services, and (2) in-depth individual diagnosis leading to remediation plans and programs. This study will be concerned with the first aspect--subjective clinical judgment for identification of learning disabilities which leads to placement in special services.

Identification of children with learning disabilities is a complex problem. Part of this complexity is due to the fact that these children sometimes manifest behavior which may be identified with other handicapping conditions such as mental retardation, emotional disturbance, or hearing deficits. Another reason is that the condition of learning disabilities may be comprised of various factors and these may exist in different combinations. However complex, identification of learning disabilities is necessary for administratively determining whether a child is in need of, or eligible for, a special program designed for such children.

The process of identifying children with learning disabilities in schools involves a decision by personnel who must adhere to legal stipulations and/or local school guidelines, but who themselves are not clinically trained. The question of how the identification made in a clinic setting by a specialist can be adapted to the public school situation was the focus of this study.

Clinical identification of learning disabilities has been a process of making decisions in the absence of complete models or complete causal explanations. In this study, it was considered to be based on synthesized perceptions drawn from past experience and knowledge concerning learning disabilities. Because the specialist has internalized his experience and training, it is difficult for him to completely articulate all the factors and their weightings which make up the decision that a child should be placed in a service for learning disabilities.

This study explored a technique for weighting certain component disabilities which may combine to produce a handicap in learning. Each component disability by itself may not be sufficient for the identification of learning disabilities even though it may have high probability of occurring in this handicap. The technique explored in this study is called "Bayesian revision of subjective probabilities". It permits expert opinion, which is given in the form of estimates, to show a probabilistic relationship between a component disability (such as memory) and the existence of learning disabilities.

TERMINOLOGY

Some terms, which require specific definitions for the purpose of this study, are the following:

1. "Learning disabilities" refers to a complex handicapping condition composed of "component disabilities," some or all of which may combine to affect efficiency in learning.

2. "Component disabilities" is a term used to refer to separate handicapping factors within central learning processes. These separate disabilities may be correlated and/or may be found to some degree in the normal population.

3. "Bayesian revision of subjective probabilities" refers to a technique for collecting and employing expert opinion, given in the form of percentage estimates, concerning probabilistic relationships among component disabilities and the existence or non-existence of learning disabilities.

4. "Specialist in learning disabilities" refers to personnel who had been invited to two federally-funded Special Study Institutes for Leadership Personnel in Learning Disabilities (Kass, 1970a; Minskoff and Lokerson, 1972).

METHODOLOGICAL BASIS

The method of extracting and interpreting the data in this study was a technique called "Bayesian revision of subjective probabilities." This technique yields a probabilistic relationship between a component disability and the existence of learning disabilities. This investigator is not aware of another attempt in special education to employ this specific research methodology. Therefore, this study is an initial attempt to investigate its usefullness as a tool for educational research in learning disabilities.

The Bayesian technique requires the application of Bayes' Theorem, which is defined as "a rule for modifying or revising expressed probabilities in the light of new evidence (Schum, 1969, p. 29)." It provides a mathematical means for estimating the probability of the existence of learning disabilities in a child when component disabilities are expressed in conditional probabilities or likelihood estimates. For a more complete review of Bayes' Theorem, refer to Good (1950), Savage (1954), or Jeffreys (1961).

Justification for the use of the Bayesian technique is expressed in the following statements:

1. Bayes' Theorem provides a means for elegantly describing data which are in the form of subjective estimates concerning the state of nature. The actual combinations of component disabilities in the handicapping condition labeled "learning disabilities" are not known precisely. The interactions between central processes and the environment further complicate the problem of identification. Only a sophisticated methodology will allow these interactions to be noted. The methodology proposed in this study is one such attempt.

2. Bayesian statistics provide a means for increasing accuracy in identification of learning disabilities by using estimates of experts. Peterson and Beach (1967) indicate that man can quantify opinion and may be conceived of as an "intuitive statistician." They maintain that he is surprisingly adept at making estimates with realistic and/or complex data. They concluded from a review of experiments on predictive estimates that, "In general, the results indicate that probability theory and statistics can be used as the basis for psychological models that integrate and account for human performance in a wide range of inferential tasks (p. 29)."

3. In order to provide public school services for children with learning disabilities, an economical and efficient identification procedure is needed. Since the most accurate identification relies heavily upon expensive clinical diagnosis, a method for analyzing clinical procedure is required. An adaptation of Bayes' Theorem provides a means for extracting the essential elements out of diagnosis for more widespread use.

STATEMENT OF THE PROBLEM

The purpose of this study was to determine the efficacy of the application of "Bayesian revision of subjective probabilities" technique in an experimental procedure for the identification of children with learning disabilities.

The specific objectives were:

1. to review the literature for a list of factors found to be related to learning disabilities,

2. to organize these factors into a systematic framework of component disabilities,

3. to construct a questionnaire for the collection of specialist opinions concerning the component disabilities,

4. to apply Bayes' Theorem and other statistical measures to the returns of the first part of the questionnaire, and

5. to conduct a supplementary pilot investigation concerning the interrelationship of the component disabilities via the second part of the questionnaire.

PROCEDURE AND RESULTS

Because the procedure in this study was sequential in nature and followed the specific objectives in order, the results of each objective determined the next procedural step.

Objective One

The first procedural objective was to review the literature for a list of factors (component disabilities) found to be related to learning disabilities. A review of various labels and syndromes resulted in a list of approximately 110 factors. A perusal of the list indicated:

1. overlap of items,

2. no consistency of language,

3. no over-all organization,

4. various purposes arising out of diverse groups,

5. incompleteness of definitions of items,

6. variability in scope,

7. impracticability due to length.

Objective Two

The second step of this investigation was to organize the characteristics found in the review of the literature into a systematic framework of component disabilities. For the technique employed in this study--"Bayesian revision of subjective probabilities"--it was necessary to prepare an instrument to which specialists in learning disabilities could respond. The questionnaire technique was chosen because it provided a structured method for gathering subjective clinical estimates of the degree to which the component disabilities exist within the entity known as "learning disabilities." If the literature in this field were conclusive, and if diagnostic tests were economical enough to use for identification purposes, clinical estimates would not need to be gathered.

There are several systems which approach the organization of underlying factors through classifying these into categories. One such system defines the classes in terms of academic skills, such as reading, writing, arithmetic, spelling; another does the classification through communication or language processes. Some systems combine both procedures.

None of the organizational schemes (Johnson and Myklebust, 1968; Myers and Hammill, 1969; Hainsworth and Siqueland, 1969; Chalfant and Scheffelin, 1969; Kirk and Kirk, 1971; Lerner, 1971) lent themselves to the needed system for collecting the data for this study. Since each of the above schemes was designed for other purposes (such as, textbook organization, review of research, and diagnostic test construction), it was determined to prepare a scheme specifically designed for this study. The advantages of such a scheme are (1) the number of component disabilities can be reduced to a manageable size by compacting these into uniform language, and (2) a more uniform mental set can be provided for the completion of the task of filling out the study questionnaire. The classification scheme which was selected allows components (both academic skill deficits and communication deficits) to be organized into a process outline.

The processes which were chosen for the outline were taken from Kass (1970b), who refers to five processes within the human being in which component disabilities may occur:

1. sensory orientation,

2. memory,

3. reception,

4. expression,

5. integration.

Objective Three

The third procedural objective was to construct a questionnaire for the collection of subjective clinical judgments concerning component disabilities in a learning disability population. This instrument contained 40 component disabilities within the process outline. Each component was theoretically assumed to be independent. This procedure was necessary because the Bayes' Theorem calls on independent data. The entire dissertation questionnaire, including instructions, follows:

Game Rules. You are requested to follow these game rules when considering the component disabilities:

Please use the definition which is given for each component disability.

Base your estimates on your experience and subjective intuition.

Component disabilities are assumed to be age-related and within the K-12 school population.

Assume integrity of peripheral senses of the children with learning disabilities.

As you consider each component disability, conceive each as being severe enough by itself to interfere with learning.

Directions for Completing the Questionnaire:

1. Complete directions a, b, and c before completing direction two.

    a. Read the definition for each component disability.

    b. In the blank labeled L.D. write your estimate of the percentage of children with learning disabilities who are likely to have this component disability.

    c. In the blank labeled Non L.D. write your estimate of the percentage of children *without* learning disabilities who are likely to have this component disability.

2. After completing directions one, go over the questionnaire again for the purpose of noting relationships among the component disabilities.

    a. Scan the definitions of the component disabilities again.

    b. Based on your clinical experience, if you think that any component disability is related to any other component disability write the number(s) of the related component disabilities in the appropriate box on the answer sheet for direction two. For example, if you estimate components 1 and 2 are related to 3, write 1 and 2 in the box numbered 3 and 3 in the boxes numbered 1 and 2, etc.

    SAMPLE BOXES:

1.	6. 2. 5, 28. 32, 39	28. 6, 9

If you think that a certain component disability is not related to any other disability, please leave the appropriate box blank.

Examples. As an example for direction one, consider a hypothetical component disability such as:

Toe tapping deficit--an impairment in the child's ability to respond quickly and consistently in toe tapping activities.

LD_____% Non LD_____%

After reading the definition, you are asked to consider the learning disability population you have observed in your clinical work. What percentage of this population do you estimate exhibit a "toe tapping" deficit severe enough to be a handicap in learning? For our example, let us assume this estimate to be x% of the learning disability population.

Now consider the same definition and think about the normal population, including all other handicaps. What percentage of this remaining population do you estimate exhibit a "toe tapping" deficit?

For our example, let us assume an estimate of y%. Please record your answers on the questionnaire as follows:

LD x % Non LD y %

While completing the estimates for the component disabilities, the thought may occur to you that one component disability may lead you to expect finding an associated component disability. Therefore, as an example for direction two, consider the hypothetical "toe tapping" deficit defined above. If you have clinically observed this hypothetical deficit, you might also expect to find a related "pattycake" deficit. If you think these hypothetical deficits are directly related, you would place the number for "toe tapping" in the "pattycake" box and the number for "pattycake" in the toe tapping box.

Please Note: (1) The non-learning disability population, for the purposes of this study, includes all normal as well as all exceptional children other than children with learning disabilities; (2) in some cases the percentage for the non-learning disability population may be higher than for the learning disability population. The inclusion of the component disabilities found in this questionnaire does not reflect a necessary relationship to the learning disability population; (3) the percentages need not add to 100%; (4) if you estimate a certain component disability is found equally in both populations, record an equal percentage for both categories; (5) there are no incorrect answers; (6) you may find it helpful to separate the pages when completing direction two, and spread them out for ease infilling out the answer sheet.

QUESTIONNAIRE

Question: What percentage of school-aged children (K-12) have learning disabilities? _____% (Please do not specify a range).

I. Sensory Orientation--the process by which the child shows a physiological or functional orientation of the sensory receptors to the states of (a) arousal, (b) body awareness, (c) discrimination of sensory information, and (d) sensory coordination.

A. Arousal means the excitability of the sensory receptors.

1. Attention deficit--an impairment in the child's ability to focus on specific sensory input. LD_____% Non LD_____%

2. Hyperexcitability--an impairment in the child's ability to control the arousal of his sensory receptors. LD_____% Non LD_____%

3. Hypoexcitability--an impairment in the activation of the child's sensory receptors. LD_____% Non LD_____%

4. Perseveration--an impairment in the child's ability to switch focus--i.e., the termination of activation of certain sensory receptors and in the subsequent arousal of other sensory receptors. LD_____% Non LD_____%

B. Body Awareness means the recognition of the spatial and temporal location of sensory input.

5. Body balance deficit--an impairment in the child's ability to maintain equilibrium. LD_____% Non LD_____%

6. Spatial deficit--an impairment in the child's ability to relate to two or more objects in space. LD_____% Non LD_____%

7. Temporal deficit--an impairment in the child's ability to locate himself within a time perspective. LD_____% Non LD_____%

8. Visual pursuit deficit--an impairment in the child's ability to follow visual stimuli. LD_____% Non LD_____%

9. Auditory direction deficit--an impairment in the child's ability to locate the origin of auditory sensory input. LD_____% Non LD_____%

10. Maturational lag--an impairment in the development of the child's body awareness system. LD_____% Non LD_____%

C. Discrimination of sensory information means the ability to note differences within any one sensory system.

11. Auditory discrimination deficit--an impairment in the child's ability to note differences within the auditory sensory system. LD_____% Non LD_____%

12. Visual discrimination deficit--an impairment in the child's ability to note differences with the visual sensory system. LD_____% Non LD_____%

13. Kinesthetic discrimination deficit--an impairment in the child's ability to note differences within the kinesthetic (muscle sensation) sensory system. LD_____% Non LD_____%

14. Tactile discrimination deficit--an impairment in the child's ability to note differences within the tactile (touch) sensory system. LD_____% Non LD_____%

D. Sensory Coordination means the integration of two or more sensory systems.

15. Visual-haptic (kinesthetic and tactile) coordination deficit--an impairment in the child's ability to receive and associate information from visual and haptic sensory system. LD_____% Non LD_____%

16. Auditory-visual coordination deficit--an impairment in the child's ability to receive and associate information from the auditory and visual sensory systems. LD_____% Non LD_____%

17. Auditory-haptic coordination deficit--an impairment in the child's ability to receive and associate information from the auditory and haptic sensory systems. LD_____% Non LD_____%

18. Auditory-visual-haptic coordination deficit--an impairment in the child's ability to receive the same information from the auditory, visual, and haptic systems. LD_____% Non LD_____%

II. Memory--The process by which the child shows (a) immediate retrieval of sensory information, (b) storing of sensory impressions through rehearsal, and (c) delayed retrieval of organized material.

19. Visual short-term memory span deficit--an impairment in the child's ability to retrieve immediately a match of the visual stimulus input. LD_____% Non LD_____%

20. Auditory short-term memory span deficit--an impairment in the child's ability to retrieve immediately a match of the auditory stimulus input. LD_____% Non LD_____%

21. Rehearsal deficit--an impairment in the child's method of storing the match of the sensory input for later recall. LD_____% Non LD_____%

22. Long-term memory deficit--an impairment in the child's ability to retrieve stored material at a delayed time after stimulus input. LD_____% Non LD_____%

III. Reception--the process by which meaning is attached to external or internal stimuli without being aware of the specific stimuli.

23. Visual figure-ground deficit--an impairment in the child's ability to gain meaning from the appropriate visual stimuli while ignoring inappropriate visual stimuli. LD_____% Non LD_____%

24. Listening comprehension deficit--an impairment in the child's ability to gain meaning from the appropriate auditory stimuli. LD_____% Non LD_____%

25. Visual closure deficit--an impairment in the child's ability to gain meaning from incomplete visual stimuli. LD_____% Non LD_____%

26. Auditory closure deficit--an impairment in the child's ability to gain meaning from incomplete auditory stimuli. LD_____% Non LD_____%

27. Reading comprehension deficit--an impairment in the child's ability to gain meaning from the printed page. LD_____% Non LD_____%

28. Mathematical comprehension deficit--an impairment in the child's ability to gain meaning from the appropriate quantitative symbols. LD_____% Non LD_____%

29. Social comprehension deficit--an impairment in the child's ability to gain meaning from the appropriate interpersonal stimuli. LD_____% Non LD_____%

IV. Expression--the process by which meaning is communicated.

30. Oral expression deficit--an impairment in the child's ability to communicate meaning through the spoken word. LD_____% Non LD_____%

31. Writing deficit--an impairment in the child's ability to communicate meaning through the written word. LD_____% Non LD_____%

32. Body language deficit--an impairment in the child's ability to communicate meaning through gestures and other physical movements. LD_____% Non LD_____%

33. Quantitative deficit--an impairment in the child's ability to communicate meaning through a mathematical system. LD_____% Non LD_____%

34. Affect deficit--an impairment in the child's ability to communicate meaning through appropriate emotional reaction. LD_____% Non LD_____%

V. Integration--the process by which separately learned components from the processes of sensory orientation, memory, reception, and expression are unified and compacted into one internal representation or gestalt (the whole is more than the sum of its parts).

35. Visualization deficit--an impairment in the child's ability to respond quickly and consistently from internal representations. LD_____% Non LD_____%

36. Sound blending deficit--an impairment in the child's ability to synthesize sounds into an internal representation. LD_____% Non LD_____%

37. Prediction deficit--an impairment in the child's ability to synthesize sounds into an internal representation. LD_____% Non LD_____%

38. Monitoring deficit--an impairment in the child's ability to recognize dissonance between his performance and his internal representations. LD_____% Non LD_____%

39. Visual speed of perception deficit--an impairment in the child's ability to respond quickly and consistently from internal visual representations. LD_____% Non LD_____%

40. Auditory speed of perception deficit--an impairment in the child's ability to respond quickly and consistently from internal auditory representations. LD_____% Non LD_____%

Objective Four

The fourth procedural objective was to apply Bayes' Theorem and other statistical measures to the 40 returns from the first part of the questionnaire. Since the questionnaire called for any percentage estimate between zero and 100%, a significant agreement in the choice of numbers by the specialists did not occur. The coefficient of concordance (Walker & Lev, 1953) was the statistical measure used to determine the amount of agreement among the specialists on the relative weightings of the component disabilities. Significant agreement was noted in the weightings assigned to the component disabilities. Therefore, Bayes' Theorem could be applied with more confidence. Another consequence of the wide choice of percentage estimates was large standard deviations. The use of means as a measure of central tendency was not representative of the amount of agreement noted by the coefficient of concordance. Therefore, the median was determined to reflect the most representative central tendency measure.

Bayes' Theorem first calls for prior probabilities which are said to represent the state of knowledge prior to observations. A prevalence estimate for the existence of learning disabilities in the school population was obtained in order to provide a starting point from which to apply

Bayes' Theorem. It represents mere chance of identifying learning disabilities without any observations. In this study, median prior probability was .05. This means that .95 is the median prior probability for the remainder of the school population.

The second step in Bayes' Theorem calls for conditional probabilities, which are the experimental observations. In this study, conditional probabilities were collected in the form of percentage estimates for the 40 component disabilities as these relate to both learning disabilities and non-learning disabilities. The resulting ratios (likelihood ratios) gave the information necessary for the third step in Bayes' Theorem, which yields posterior probabilities, or revised estimates after the observations have been made. Posterior probabilities reflect the confidence with which learning disabilities can be identified. A demonstration of the application of Bayes' Theorem to the likelihood ratios, given in decreasing rank order, showed that five component disabilities were required to reach .95 level of confidence; four were required to reach .90 and .85; and only three were required to reach .80. Similar demonstrations were presented for each of the five processes from the questionnaire outline.

A demonstration of the application of Bayes' Theorem using the component disabilities from the decreasing rank order of the likelihood ratios follows:

1. The prior probabilities for LD and Non-LD populations are

   $P\ (H_1) = .05$

   $P\ (H_2) = .95$

2. The conditional probabilities for component disability No. 1, attention deficit (CD_{ad}), given hypotheses 1 and 2, are

   $P\ (CD_{ad} | H_1) = .50$

   $P\ (CD_{ad} | H_2) = .10$

3. The above information yields the posterior probabilities for hypotheses 1 and 2, given CD_{ad}, which are

   $$P\ (H_1 | CD_{ad}) = \frac{.50 \times .05}{.50 \times .05 + .10 \times .95} = .21$$

   $P\ (H_2 | CD_{ad}) = 1 - .21 = .79$

The above demonstration shows that the posterior probability (that an attention deficit will identify learning disabilities) is 21%. The ideal in identification would, of course, be a probability as close to 100% as possible. Bayes Theorem can accurately increase probabilities through a process of adding additional component disabilities sequentially. A continuation of the above demonstration, taking each component disability in order is the following:

4. Posterior probabilities derived from the data for CD_{ad} (calculated above) now substitute for the prior probabilities in the previous hypotheses [$P(H_1) = .05$ and $P(H_2) = .95$] as

$P(H_1 | CD_{ad}) = .21$

$P(H_2 | CD_{ad}) = .79$

5. Conditional probabilities for component disability No. 16, auditory-visual coordination deficit (CD_{avc}), are

$P(CD_{avc} | H_1) = .40$

$P(CD_{avc} | H_2) = .10$

6. The above information yields the posterior probabilities for the substitute hypotheses 1 and 2, given CD_{ad} and CD_{avc} which are

$P(H_1 | CD_{ad,avc}) = .52$

$P(H_2 | CD_{ad,avc}) = .48$

7. Posterior probabilities derived from the data $CD_{ad,avc}$ now substitute for the prior probabilities for CD_{ad} as

$P(H_1 | CD_{ad,avc}) = .52$

$P(H_2 | CD_{ad,avc}) = .48$

8. Conditional probabilities for component disability No. 35, visualization deficit (CD_{vd}), are

$P(CD_{vd} | H_1) = .40$

$P(CD_{vd} | H_2) = .10$

9. Posterior probabilities are

$P(H_1 | CD_{ad,avc,vd}) = .81$

$P(H_2 | CD_{ad,avc,vd}) = .19$

10. Substitute prior probabilities are

$P(H_1 | CD_{ad,avc,vd}) = .81$

$P(H_2 | CD_{ad,avc,vd}) = .19$

11. Conditional probabilities for component disability No. 40, auditory speed of perception deficit (CD_{as}), are

$P\ (CD_{as}|H_1) = .38$

$P\ (CD_{as}|H_2) = .10$

12. Posterior probabilities are

$P\ (H_1\ CD_{ad,avc,vd,as}) = .94$

$P\ (H_2\ CD_{ad,avc,vd,as}) = .06$

13. Substitute prior probabilities are

$P\ (H_1|CD_{ad,avc,vd,as}) = .94$

$P\ (H_2|CD_{ad,avd,vd,as}) = .06$

14. Conditional probabilities for component disability No. 24, listening comprehension deficit (CD_{lc}), are

$P\ (CD_{lc}|H_1) = .30$

$P\ (CD_{lc}|H_2) = .10$

15. Posterior probabilities are

$P\ (H_1|CD_{ad,avc,vd,as,lc}) = .98$

$P\ (H_2|CD_{ad,avd,vd,as,lc}) = .02$

16. Substitute prior probabilities are

$P\ (H_1|CD_{ad,avc,vd,as,lc}) = .98$

$P\ (H_2|CD_{ad,avd,vd,as,lc}) = .02$

17. Conditional probabilities for component disability No. 26, auditory closure deficit (CD_{ac}), are

$P\ (CD_{ac}|H_1) = .28$

$P\ (CD_{ac}|H_2) = .08$

18. Posterior probabilities are

$P\ (H_1|CD_{ad,avc,vd,as,lc,ac}) = .994$

$P\ (H_2|CD_{ad,avc,vd,as,lc,ac}) = .006$

19. Substitute prior probabilities are

$P(H_1 | CD_{ad,avc,vd,as,lc,ac}) = .994$

$P(H_2 | CD_{ad,avc,vd,as,lc,ac}) = .006$

20. Conditional probabilities for component disability No. 27, reading comprehension deficit (CD_{rc}), are

$P(CD_{rc} | H_1) = .55$

$P(CD_{rc} | H_2) = .13$

21. Posterior probabilities are

$P(H_1 | CD_{ad,avc,vd,as,lc,ac,rc}) = .999$

$P(H_2 | CD_{ad,avc,vd,as,lc,ac,rc}) = .001$

This procedure can be followed through all the component disabilities without ever actually reaching the ideal 100% because the line plotted from the probabilities is asymptotic in nature.

Objective Five

The fifth procedural objective was to conduct a supplementary pilot investigation concerning the interrelationship of the component disabilities via the second part of the questionnaire. An important constraint which must not be ignored in the application of Bayes' Theorem concerns the independence or non-independence of the component disabilities. In this study, the component disabilities were theoretically assumed to be independent. However, if non-independence were the case, the output of Bayes' Theorem would be inflated. Percentage estimates would have to be collected, not only for the two hypotheses (H_1: LD exists, and H_2: non-LD), but for all related component disabilities in order to correct for this inflation. In this study, the specialists were asked to judge only whether such relationships do exist, not the degree to which they exist. The 26 specialists who responded to this portion of the questionnaire indicated that, while some component disabilities were not related to each other, no component disability was totally independent from all others.

CONCLUSIONS

Based on the justification for the methodology and the process outline of component disabilities, this study yielded the following findings:

1. The manner in which the 100 specialists responded to the questionnaire varied:

   a. 41 did not respond,

   b. 19 disqualified themselves or gave reasons for non-participation,

c. 40 responded to the first part of the questionnaire,

d. 14 out of the 40 did not respond to the second part of the questionnaire,

e. 26 responded to both parts of the questionnaire.

2. The 40 learning-disability specialists were in agreement concerning the relative weightings assigned to the component disabilities. This result was demonstrated through the application of coefficients of concordance.

3. The application of Bayes' Theorem indicated that the most efficient identification of learning disabilities can be made by using those component disabilities with the highest likelihood ratios.

4. Based on the likelihood ratios, the three most discriminating component disabilities for the identification of learning disabilities were attention deficit, auditory-visual coordination deficit, and visualization deficit.

5. When processes were compared, the results indicated the following:

a. Sensory orientation and integration processes contain component disabilities which seem to be the most effective identifiers.

b. Reception and expression processes appear to have the least effective identifiers.

c. The memory process has the fewest number of component disabilities and consequently yields the least information. However, at the .80 level of confidence, the memory process is as effective as the sensory orientation process or the integration process.

6. A pilot investigation considered the independence or non-independence of the component disabilities. The 26 specialists who responded to this portion of the questionnaire indicated that no component disability was independent from all others although some were not related to each other.

LIMITATIONS OF THE RESULTS

The investigator would like to specify some limitations of this study.

1. "Specialists in learning disabilities" were defined as personnel who had been invited to two federally-funded special study institutes for leadership personnel in learning disabilities. It would be of interest to know if different weightings of the component disabilities and/or different prior probabilities would result from other groups of personnel associated with children with learning disabilities.

2. The questionnaire outline was based on one method of classifying component disabilities. Various other methods could be employed and might yield different results.

3. The language and terminology used in this study may not be in common use by the specialists. Use of different definitions, examples, descriptive situations, or test scores may alter the results.

IMPLICATIONS FOR FURTHER RESEARCH

Any initial investigation may yield results which could lead to further study or net zero. This study, as an initial investigation, can be interpreted as leading to further study. Since the advent of services for learning-disability children, there has been a need for improved screening procedures. This study does not provide the total answer to such a need, but does plant a seed concerning the type of methodology which may lead to a streamlined identification procedure in the future.

The method of exploiting clinical judgment concerning component disabilities has been shown to be worthy of further research. Future research, particularly in reference to the experimental methodology, may follow several avenues:

1. Bayesian technique may be adapted to account for non-independence of component disabilities. As was noted in this study, specialists indicated that no component disability was independent from all others. However, they were asked to judge only whether such relationships do exist, not the degree to which these exist. This question should be researched further. A possible procedure would be to collect conditional probabilities from specialists specifically calling for percentage estimates of the relatedness of the various component disabilities.

2. Bayes' Theorem could also be applied to assets as well as deficits. Research concerning the effect which assets may have in identification procedure needs to be conducted. A possible procedure would be to collect percentage estimates for components defined in asset form as well as deficit form.

3. Bayes' Theorem could be applied in identification procedures for all of special education (including the gifted). The procedure would be to collect prior and conditional probabilities of the type used in this study for each exceptionality.

4. Research concerning the problem of the level of confidence which is desired for screening purposes needs to be done.

5. Another problem which needs investigation concerns the level at which a component disability would, for example, be considered a "significant" deficit. The questionnaire used in this study asked the specialists to consider each component disability as being severe enough, by itself, to interfere with learning. They were asked to base their estimates on their experience and subjective intuition, not on actual test data.

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APPENDIX M

REPORT OF THE UNIVERSITY OF ARIZONA STUDENT TASK FORCE

James A. McLoughlin, Chairman
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August 1972

INTRODUCTION

The University of Arizona Student Task Force was formed to study the future directions of the field of learning disabilities as perceived by the future leaders in the field, students in learning-disability doctoral preparation programs. In order to gather data on the perceptions of these students, a letter soliciting student position papers was sent to program chairmen of the twelve federally-funded learning-disability doctoral programs. These programs are located at the following universities:

University of Arizona
University of California at Los Angeles
George Peabody University
Georgia State University
University of Illinois
University of Kansas
University of Minnesota
Northwestern University
University of Southern California
Teachers College, Columbia University
Temple University
University of Virginia

Excerpts from this letter follow:

> The University of Arizona Student Task Force, made up of post-master's students in learning disabilities, is interested in surveying all doctoral students in federally-funded learning-disability programs. Our purpose is to learn how students, as future leaders in the field, perceive their future roles in the field and the direction in which the field is changing.
>
> We are requesting that each of your doctoral students prepare a short position paper on the topics detailed in the enclosed guidelines. These topics are: (1) role aspirations, (2) research interests, and (3) perception of the field and your training program. Please distribute these guidelines to your doctoral students and encourage them to submit a paper.
>
> We plan to hold a meeting of doctoral students in learning disabilities at the CEC Convention in March. The purpose of this meeting is to discuss the trends revealed in these papers.

Papers were received from the following students:

University of ARizona: James DeRuiter, Donald Deshler, Marilyn Johnson, Charles Kaiser, James McLoughlin

Georgia State University: Margaret Sullivan

University of Illinois: John D. Clark

University of Kansas: Margaret Leoni, Larry J. Little

Northwestern University: Diana German, Claudia A. Ralbovsky,
Jennifer C. Zvi

Temple University: Betty Hare, Valaida Walker

These students, along with any other interested doctoral students in learning disabilities, were invited to attend a meeting sponsored by the Student Task Force at the CEC Convention on March 23, 1972. At this meeting, the following report of the survey was presented.

REPORT OF THE SURVEY

Role Aspirations

One individual entitled her paper, "Where to Spend a Nickel." This reflects the dominating attitude of learning-disability doctoral students toward future roles, which is: there is so much to do in a young field like ours, where can I contribute the most with what I've got?

First, then, many people saw themselves in the role of teacher trainer. The orientation toward teacher training seems in keeping with the avowed priority of most programs to train teacher-trainers.

Second, many people saw their desires for research and child service roles intimately bound up with their roles as a teacher trainer. Variations on the theme were:

a. to have a model teacher training program at a small college

b. to be a part-time instructor and have a private caseload

c. to be a trainer in a university-school system consortium

d. to do research and training in a university setting

e. to do research and training, to have a lab school situation with interdepartmental cooperation

f. to train personnel, though not restricted to the university environment

g. to teach at the university and conduct mini-type research to the end of making myself a better teacher.

Third, the above comments also lead to the impression that many people aspire to a university setting which has a climate conducive to their many interests and which offers close interdepartmental cooperation and close association with the schools. For instance, one student commented, "My job aspirations are not toward a particular position but rather toward a kind of atmosphere."

Fourth, one individual looked forward to his first position as a period of experience beyond his program.

Fifth, some individuals expressed a desire to sometime in the future:

a. have my own clinic

b. be a consultant

c. have my own diagnostic clinic.

Finally, many felt that the university setting must undergo some major modifications in order to more effectively train teachers, do research, and service children.

Research Interests

First, many people were interested in research regarding preventive measures. For instance:

a. a parent rating scale to aid parents of preschool youngsters

b. discovery through syntactic abilities the underlying semantics of language acquisition in the behavior of the preschool child

c. motor behavior of the preschool child as assessed by an observational rating scale using trained and untrained observers.

Second, many people were interested in research concerning teachers and teacher training. For instance:

a. factors relating to cooperation between regular and special teachers

b. measurement of teacher competency, including the influence of training and importance of attitudes and personality

c. teacher training methods

d. teacher-learner interactions at the affective level.

Third, many people expressed research interest in process deficits:

a. child language acquisition in terms of psycholinguistic structures

b. designing pilot studies to investigate auditory, visual, and auditory-visual short term memory

c. nature of psycholinguistic abilities, especially attention and memory.

Fourth, language acquisition and language disorders figured high as research interests.

Fifth, examinations of delivery systems for services to children were of research interest:

a. the resource room model for educating moderately mentally retarded children

b. the definition, efficacy of administrative set-ups, and remediation and assessment techniques.

Sixth, many expressed desire to engage in small-scale research or descriptive research:

a. idiographic study of two severe learning-disability children

b. forego research in the traditional sense in exchange for a period of description regarding types of training, predominant intervention strategies, etc.

Comments on Present Doctoral Training Programs

The overwhelming consensus was that the students were enjoying a stimulating and flexible LD program. They felt adequately prepared for teacher-training and child service. Some constructive comments in regard to teacher training and child service preparation were:

a. perhaps more time to simmer information

b. more opportunitites to be exposed to "outside" influences

c. more psychology

d.. supervision in college teaching

e. more university-based clinics and labs

f. more emphasis on new ideas, like the non-categorical movement.

Second, a number of people felt somewhat unprepared in the area of research:

a. research training was too academic

b. a need for more supervised small "mini-research" exercises.

Third, in regard to administration people either were not concerned about it since they were not interested in it, or felt they had been trained, or they had been trained in an informal manner.

Comments on the Training Institution of the Future

Most people expressed confidence that the university would and even should remain the major teacher training institution. However, some modifications may be in order:

a. the university should remain the primary training institution, but they must work closely with state certifying boards

b. the university, with more involvement with the State Department

c. in cooperation with public and private schools

d. rests with the LD departments within the colleges and universities; interdepartmental relations should be established.

A few people expressed a strong desire for a more formal tie between the university and school system:

a. the public schools and universities should be administratively and operationally commited to joint teacher-training responsibility. State departments will have to assume the initial leadership by drafting enabling legislation for this consortium.

b. will be a joint program of the university and the public schools. . . will be in-school teacher training

c. has been, is, and will be the individual schools and teaching staff. . . the university must realign itself.

APPENDIX N

A SYSTEM OF OBJECTIVES BASED ON BLOOM'S TAXONOMY (COGNITIVE DOMAIN) APPLIED TO PERSONNEL PREPARATION IN LEARNING DISABILITIES

Corrine E. Kass

August 1972

The following system of objectives is suggested as a means for the planning and implementation of training programs in learning disabilities. The classification system is based on the taxonomy of educational objectives edited by Benjamin S. Bloom (cognitive domain only). The numbering systems and the major classes are the following:

1.00 Knowledge
2.00 Comprehension
3.00 Application
4.00 Analysis
5.00 Synthesis
6.00 Evaluation

While all objectives can be incorporated into all degree programs, this model proposes only those objectives which can be comprehensively taught to the level of competence possible within the time frame of any degree program (i.e., master's level, educational specialist level, and doctoral level). Therefore, only the first three major classes appear under the objectives for the master's level program; the next two, under the educational specialist; and the last three major classes (4.00 through 6.00) under the doctoral program.

OBJECTIVES FOR A MASTER'S PROGRAM IN LEARNING DISABILITIES

The overall goal of the master's level program in learning disabilities is to prepare itinerant, resource room, and special class teachers who are able to (1) diagnose learning disabilities through the use of informal and selected formal tests, and (2) plan and carry out remediation. The specific knowledges to be developed are the following:

1.00 Knowledge about the characteristics of learning disabilities, as learned from the program course work and the literature in the field. The student will be able to recall the following about the field to the specifications within a given program:

1.10 The student will be able to recall specific information in the field of learning disabilities to the point of recognition and verbalization. The specific information to be recalled will include

1.11 terminology in learning disabilities

1.12 dates, events, persons, places, etc., pertinent to the field.

1.20 The student will be able to take the specifics learned under 1.10 and organize, study, judge, and criticize these. The student will learn the methods of grouping specifics to the point of recognition and verbalization. These organized systems will include:

1.21 commonly-accepted professional conventions dealing with the organization of facts in this field

1.22 historical perspectives of learning disabilities as reflected in trends

1.23 classifications and categories relating to administrative arrangements of services, types of learning disability, types of personnel needed, and methods and materials

1.24 criteria by which children with learning disabilities are identified, diagnostic instruments are selected, and remedial programs are prepared; the specific information here centers around the classification of tests and remedial materials

1.25 the methodology necessary for use of remedial techniques and materials, and of diagnostic instruments specific to the field; in addition, the student acquires basic statistical information and techniques of educational research.

1.30 The student will be able to recognize and verbalize the major schemes and abstractions by which the ideas in learning disabilities are organized. The major abstractions in the field of learning disabilities deal with

1.31 principles of diagnostic testing, both individual and group, both formal and informal, principles of remediation, and principles of relating remediation to diagnosis

1.32 theoretical structures from a variety of disciplines which add relevant information to the understanding of learning disabilities; such theories can come from the fields of learning, child development, neurophysiology, language and communication, medicine, education, special education, etc.

The next set of objectives requires intellectual abilities and skills dealing with techniques of using the specifics acquired under the previous objectives in actual problem-solving in the field of learning disabilities. The student will be required to show the following knowledges to the point of demonstrating the application of these to the practicum situation: (1)terminology, (2) population characteristics, (3) names of tests and remedial procedures, (4) statistical interpretation of tests, (5) action research tools, (6) principles of individual testing and remedial procedures, and (7) clinical interpretation of case data. The specific abilities and skills to be developed are the following:

2.00 Comprehension of the concepts underlying test information and referral information about the child. The specific skills in comprehension include:

2.10 skill in translating statistical test data into educational terms

2.20 interpretation or summarization of all data pertinent to a learning disability

2.30 extraction, or the ability to devise diagnostic hypotheses from such data.

3.00 The student will be able to make application of the principles of diagnosis and remediation and the theoretical formulations having relevance for learning disabilities in concrete situations dealing with actual children in both the clinic situation and the public schools. Practica provide experiences for the acquisition of application skills.

OBJECTIVES FOR THE EDUCATIONAL SPECIALIST PROGRAM

In addition to the objectives of the master's level program in learning disabilities, the overall goal of the educational specialist program in special education is to prepare personnel who are able to: (1) organize and administer special education programs, (2) provide liaison between special education and general education, (3) acquire advanced competencies as delineated in objectives 1.00 through 3.00 above, and (4) supervise clinical and public school programs for learning-disability populations. Following the taxonomy of educational objectives, the skills which are added to the knowledge and skills acquired for the master's level are the following:

4.00 The student will be able to analyze his experience with handicapped children into a hierarchy of concepts in order to convey both to school administrators and referring teachers what is necessary in order to identify and screen handicapped children and plan for relevant educational experiences. This analysis includes the ability to

4.10 specify what information about handicapped children stems from facts and what information stems from hypotheses

4.20 distinguish relevant data about handicapped children from irrelevant data

4.30 recognize the organizational principles underlying their experiences.

5.00 The student will be able to combine the facts and hypotheses in a synthesis or framework for organizational and administrative purposes. The synthesis results in

5.10 the ability to communicate his own professional opinions

5.20 the development of an administrative plan for screening, identifying, and providing diagnostic remedial services

5.30 the ability to derive implications from an analysis of the application of the administrative plan and to modify the plan accordingly.

OBJECTIVES FOR THE DOCTORAL PROGRAM

In addition to the knowledges and skills acquired in a master's degree program in learning disabilities, the overall goal of doctoral preparation is to prepare leaders who are able to (1) provide administrative leadership at the federal, state, and local levels, (2) train teachers in both pre-service and in-service programs, and (3) carry out significant research in the field of special education. The specific intellectual abilities and skills to be added to the objectives at the master's degree level are the following:

4.00 The student will be able to analyze the concepts as learned under major class 2.00 and as applied under major class 3.00, and place the parts into an integrated whole. The specific skills in analysis include the ability to

4.10 distinguish a conclusion about handicapped children from the statements which support that conclusion

4.20 recognize the particular statements which are relevant to the validation of a judgment about handicapped children

4.30 understand the relationships between particular statements about handicapped children to the organized conclusions.

The ability to synthesize is specific to the doctoral program because of the time factor relating to professional synthesis. Synthesis does not seem to be possible until a specialist in special education has acquired the specific knowledge and the actual comprehension and application of the knowledge in experience. The sequence seems to be the acquisition of a number of specific bits of information, grouping these into wholes which can be understood and applied, next breaking down the structures into component ideas and elements for communication purposes, and finally being able to redo knowledge and experience into novel arrangements.

5.00 The student will be able to synthesize all of the previously learned specifics, principles, and theories, and be able to evolve novel theories and principles and add specifics through research. The synthesis results in the following:

5.10 the ability to communicate a personal insight with relation to some theoretical formulation in the literature

5.20 the development of hypotheses relating to research plans and designs

5.30 the ability to derive implications and to be able to modify plans and methodologies.

6.00 The student will be able to make evaluative judgments, both quantitative and qualitative, regarding the value of concepts in special education as they relate to service to children, training of teachers, and research design. These evaluations require the ability to

6.10 evaluate on the basis of internal evidence such as statistical treatments, logical consistency, and accuracy

6.20 evaluate through the use of external criteria such as comparison and contrasts of major theories and comparison with highest known standards in the field of special education.

APPENDIX O

LEARNING-DISABILITY TEACHER CERTIFICATION IN THE FIFTY STATES*

Robert L. Minniear

August 1972

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*This paper was prepared from data collected for a doctoral dissertation, tentatively entitled An Evaluation of the Criteria Used in Establishing Teacher Training Programs at a Select Group of Colleges and Universities in the United States, under the supervision of Dr. Marjorie Snyder at Northeast Louisiana University, Monroe, Louisiana.

In February, 1972, a request for information concerning teacher certification in learning disabilities and the status of training programs was sent to the certification departments and special education departments of each state.

By June 1, 1972, a 100% response to the request was received. The responses ranged from a rather terse "no" to the question of whether LD requires special certification in a certain state to a generous sharing of ideas and information about pending plans and existing requirements and programs.

The survey to the 50 certification directors (Canada, District of Columbia, and other outlying areas were not contacted) was brief and patterned after the earlier information sought by Dr. Lita Schwartz in 1968-1969 for the Association for Children with Learning Disabilities (ACLD) Legislative Committee Report prepared for the 6th International Convention of ACLD held in Fort Worth, Texas, March 1969.

The respondents were asked to indicate whether certification was necessary for teachers of children with LD and if not, if such a requirement was planned for the near future. They were asked to indicate whether similar requests for information had been made in the last two years. A list of the colleges and universities offering training programs leading to certification in LD was also requested.

ALABAMA

Alabama has indicated that an endorsement in LD may be included on the teaching certificate, Class B (8 years) and Class A (10 years). Guidelines and the names of schools having training programs were forwarded. They are Auburn University (Auburn), the University of Alabama (Tuscaloosa) and the University of Alabama (Huntsville). The latter offers Early Education of the Handicapped.

ALASKA

Alaska indicates that certification for LD teachers is required. They forwarded a proposed program for an undergraduate minor in Special Education at the University of Alaska (Anchorage) which includes electives in LD. Included in the Master's degree program in special education were a required three hour course in Theories of LD and two "strongly recommended" three hour workshops.

ARIZONA

Arizona has responded that certification in LD is required. They have shared an Evaluation Report form in special education which includes space for background in LD. It has been indicated that two schools provide training, Arizona State (Tempe) and the University of Arizona (Tucson).

ARKANSAS

Arkansas requires certification in LD and has included an amended guideline for emphasis in mental retardation (MR). Instead of the MR classes a trainee may elect three courses related to LD for emphasis in that field. The course titles are Nature and Needs for Children with SLD, Education Procedures for Children with SLD, and Directed Teaching in the Field of SLD. Schools offering training programs in Arkansas are State College of Arkansas (Conway), Henderson State College (Arkadelphia), and the University of Arkansas Medical Center (Little Rock).

CALIFORNIA

California requires an endorsement for the areas referred to here as LD. On the extensive guidelines provided this writer the children are classified as Educationally Handicapped (EH). Enclosures dated April and May, 1971 state that authorization for teaching credentials shall be of four basic kinds. Among them is "Specialists instruction" which includes among other preparations those requiring advanced preparation or special competence in teaching the EH child. This state department has provided a list of 20 institutions using "EH Teacher Loans". (Title V I-B WD-7 SED), and 12 other colleges and universities are listed as providing "some courses toward at least one special education credential".

COLORADO

In Colorado "a teacher who holds a valid certificate may have it further endorsed" upon completion of the prescribed program in the area. For such endorsement completion of the Master's is also required. These guidelines are dated March 1, 1968. Schools offering the appropriate courses are the University of Northern Colorado (Greeley), Denver University (Denver), the University of Colorado (Boulder), and Adams State College (Alamosa).

CONNECTICUT

From Connecticut has come word that special certification in LD is not required, but that new regulations have been formulated and submitted for review. They suggest that sometime during this summer more recent information may be available. Five schools that "maintain graduate and undergraduate training programs in LD" are Southern Connecticut State College (New Haven), Central Connecticut State College (New Britain), the University of Connecticut (Storrs), Saint Joseph's College (West Hartford), and Fairfield University (Fairfield).

DELAWARE

Specific certification requirements for teachers in the area of LD are not necessary in Delaware. However, the guidelines indicate that the local district Superintendent may recommend qualified personnel in LD and assign on the basis of whatever valid certificate he holds. From the survey question about future requirements the response is yes, but no elaboration has been given. A list of schools with training programs in Delaware is not included at this time.

FLORIDA

Florida anticipates that certification will be required "before summer". The guidelines of proposed State Board of Education Regulations for Exceptional Child Education (E Ch Ed) provide for certification in the area of SLD. Three levels are outlined, Rank III: a bachelor's degree with major in E Ch Ed with specialization in LD; Rank II: a master's degree with graduate major in E Ch Ed with specialization in LD; and Rank I: a doctor's degree with doctoral major in E Ch Ed with specialization in LD. The explanation here is a brief summary of that forwarded, which is more detailed as to course outlines, etc. Three universities have programs for LD; Florida State University (Talahassee), the University of Florida (Gainesville) and the University of Miami (Coral Gables).

GEORGIA

The teacher certification guidelines for Georgia show that the area of LD is covered (Revision August 1971). Specific certificates are available on the undergraduate as well as the graduate level. Two universities have approved training programs. They are Georgia State University (Atlanta) and the University of Georgia (Athens). Four others are interested in initiating teacher training programs in LD.

HAWAII

In Hawaii teacher certification requirements for special education include the area of SLD. The guidelines indicate the general requirements for such endorsement, and the University of Hawaii (Honolulu) provides the appropriate training program.

IDAHO

Idaho expects that a teacher will be certified in order to work with LD children. The state guidelines refer to this population also as the Perceptually Impaired. Two levels of endorsement in this area are possible: the Interim certificate for teaching Perceptually Impaired children (LD), and the full endorsement. The Interim requires a minimum of 15 semester hours and the full endorsement 30 semester hours. Other details are not outlined here. Two universities suggested as having the necessary programs are Idaho State University (Pocatello) and the University of Idaho (Moscow).

ILLINOIS

Certification in LD is required in Illinois. Two levels are available: "Approval" and "full certification". The approval system will be dropped in October and the training programs now in existence should be improving their programs for the change. The special certificate will be issued in the area of LD after completion of 32 semester hours in course areas including a survey of exceptional children, characteristics of LD, methods in LD, diagnosis, and student teaching in LD. A list of 12 institutions offering various training programs in LD was sent.

INDIANA

Indiana has no provision for teacher certification in the area of LD as a specific exceptionality. The respondents indicate that plans are for certification in the next three years. There is training in the area of LD at four universities, including Purdue University (Lafayette), Indiana University (Bloomington), Indiana State University (Terre Haute), and Ball State University (Muncie).

IOWA

Iowa responded that they are presently in the process of developing the special criteria necessary for certification in the area of LD. As of April, 1972, there were no approved training programs in LD. They do anticipate that there will be at least four such programs at the four major universities by fall.

KANSAS

From the Certificate Handbook of Kansas, it appears that no specific certification requirements are established as yet. In the area of Special Education special approval may be granted individuals who teach the neurologically impaired. It appears that such approval may be extended one year at a time. The list of training institutions for workers with Exceptional Children lists the University of Kansas (Lawrence) as having an LD program.

KENTUCKY

The LD population in Kentucky is termed the neurologically impaired (NI) and provision for specific certification in this area is made. A minimum of 14 semester hours in special education with emphasis on the NI is sufficient for credentials. The universities listed as having specific programs in the NI area are Eastern Kentucky University (Richmond), the University of Kentucky (Lexington), and the University of Louisville (Louisville).

LOUISIANA

Louisiana has no requirement for certificaiton in LD. A special education option is possible with the undergraduate degree. Certification requirements in LD have been proposed for approval, but no word on the outcome of this effort is available at present. There are eleven special education centers throughout the state and the universities to which they are attached are providing a variety of tentative programs of training. The area of LD is included in these efforts.

MAINE

Maine requires certification of the LD teacher. It may be attained on the provisional level (undergraduate) or professional level (Master's or above). The details are not spelled out here. Schools offering the appropriate training are the University of Maine (Orono) Bates College (Lewiston), the University of Maine (Farmington) and the University of Maine (Gorham).

MARYLAND

In Maryland we have different responses from two sources. A consultant in Curriculum Development indicates that no specific certification requirement is available in LD but that one is under study. Another member of the state department staff states that certification is required. The accompanying guidelines provide for certification in special education to those who teach children with such handicaps as orthopedic handicaps with associated learning problems, mental retardation, visual limitation, emotional handicap and other learning disorders. The qualifications for such certification seem to stress the exceptional child and mental retardation. The two schools cited are Coppin State College (Baltimore) and the University of Maryland (College Park). Learning-disability training per se does not seem to be provided for here.

MASSACHUSETTS

In Massachusetts, "tentative approval" is the only form of certification awarded. This approval is granted to a superintendent who has hired an individual for an LD position in his system. The superintendent exercises local option concerning training degree, etc., in selecting a candidate. The area covered is education for the perceptually handicapped. A minimum of three semester hours in this field is needed for consideration. The respondent also suggested 14 colleges and universities as having contacts in special education that might be helpful in further delineating the Massachusetts program.

MICHIGAN

Michigan presently has no specific requirements for certification in LD. As of March 1, 1972, there are 36 experimental programs for LD operating in the state, however, and proposed rules governing certification will be acted upon sometime this calendar year. The category of LD is to be added to this part of the school code. Certification requirements will be "competency based". Wayne State University (Detroit), and Michigan State University (East Lansing) have LD listed in their special education programs.

MINNESOTA

Minnesota appears to have separate certification for SLD (special LD, emotionally disturbed and socially maladjusted) or SLD (learning disabled). A minimum of 30 quarter credits at an approved program is required. Valid elementary or secondary teaching certification is also required. Seven institutions are listed as having approved LD training programs.

MISSISSIPPI

Mississippi provides for special endorsement for LD with the master's degree if the subject also qualifies for a "Class A" certificate (bachelor's degree). The endorsement certificate is referred to as "Class AA". Five universities or colleges have training programs in LD.

MISSOURI

Missouri has certification standards for teachers of children with LD (July 1, 1972). These appear to be on the undergraduate level. Eight institutions are known to have training programs in LD.

MONTANA

From Montana there appears to be a conflicting interpretation of the requirements. Special education generally is included by endorsement, but LD is not specifically mentioned in guidelines. The state department does anticipate such provision in the future. Three schools are mentioned as having appropriate training programs. They are Montana State University (Bozeman), the University of Montana (Missoula), and Eastern Montana College (Billings).

NEBRASKA

Nebraska reports that no certificate endorsement is available at the present time. The University of Nebraska (Omaha) is offering a limited program program in LD, and legislation is just beginning.

NEVADA

The teacher certification department of Nevada states that certification is necessary in LD. However, the guidelines appear to refer only to special education endorsement in the following areas: visually handicapped, aurally handicapped, emotionally and socially maladjusted, mental retardation, physically handicapped, speech correction, and teaching the gifted. Suggested contacts are the University of Nevada at Reno and Las Vegas.

NEW HAMPSHIRE

Certification for teachers of the neurologically impaired is required in New Hampshire. This is a separate entry for teachers of the Physically Handicapped. The one school offering a training program at the master's level is Keene State College (Keene).

NEW JERSEY

New Jersey provides full certification to the LD teacher consultant who has a valid New Jersey certificate, three years of successful teaching, a master's degree and completion of a graduate certification program in LD. The provisional certificate has less strict requirements. The above requirements are not for classroom teachers but for members of child study teams. Classroom teachers of LD hold certification as "teacher of the handicapped". Seven colleges and universities have approved programs (seven certificate programs and six of them offer degrees in LD).

NEW MEXICO

New Mexico does not yet have requirements for certification in LD. It is hoped that in the next few years the special education requirements will become more specific. The University of New Mexico (Albuquerque) has a personnel training program in LD.

NEW YORK

New York has no specific certification for LD. At the discretion of the employing superintendent any certified teacher may be hired for this purpose. Competency based certification is hoped to be fully in effect within the next ten years. LD will probably fall within this framework. Other than those listed for teachers of the mentally retarded, physically handicapped, and speech and hearing, no schools are mentioned as having LD programs. Further contact must be made for this statement to be considered accurate.

NORTH CAROLINA

North Carolina reports that it does not have certification requirements for teachers in the area of LD. The Standards and Guidelines for the Approval of Institutions and Programs for Teacher Education is in the process of being revised and is to be set up by the competencies a teacher should have instead of a number of courses. Two institutions are planning degree programs in LD in the near future. They are the University of North Carolina (Chapel Hill) and Salem College (Winston-Salem).

NORTH DAKOTA

North Dakota requires a special education credential for teachers and supervisors in specific LD and for teachers of the emotionally disturbed. Courses are listed in the guidelines and the University of North Dakota (Grand Forks) offers a program in LD.

OHIO

Ohio has new guidelines in special education including a new certificate for LD and behavioral disorders (effective Jan. 1, 1972). Seven institutions are listed as having appropriate programs.

OKLAHOMA

Oklahoma offers a Standard Certificate in Special Education - Learning Disabilities. A minimum of 24 semester hours is required with emphasis in the area of LD. Two colleges have approved training programs. They are Central State University (Edmond) and East Central State College (Ada).

OREGON

Oregon has forwarded the guidelines or "Specialist Norms" for certification. Included are the requirements for "Extreme Learning Problems Exclusive of M.R." which is their "label for the LD category." They are considered minimal, and specific course requirements are established by the approved teacher training institutions. The four approved for training the LD area are the University of Oregon (Eugene), Oregon College of Education (Monmouth), Oregon State University (Corvallis) and Portland State University (Portland).

PENNSYLVANIA

The guidelines received from Pennsylvania do not show specific requirements in the area of LD. Other special education areas are covered, however, and only one university (Temple in Philadelphia) has a formal program in LD. It should be noted, though, that chapter 10 of the regulations of the State Board of Education of Pennsylvania seems to imply that certification in specialized areas for endorsement to an Educational Specialist Certificate may be requested by the Superintendent of Public Instruction if certain requirements are met.

RHODE ISLAND

Rhode Island has replied that no specific certification is available for LD. Presently a person dealing with LD must be certified under the physically handicapped (neurologically impaired). The rules and regulations are currently in the process of revision and guidelines for LD will be formulated. Rhode Island College (Providence) has a program for NI which prepares teachers to service LD children.

NORTH CAROLINA

The respondent from North Carolina notes that teachers with the B.A. or B.S. who "wish to do extra work" may undertake special preparation for LD. The requirements listed are to become effective July 1, 1973, and are optional prior to that date. The schools listed do not offer full certification in LD. They are Columbia College (Columbia), Winthrop College (Rock Hill), and Furman University (Greenville). Central Wesleyan College (Central) plans a program within the next few years.

SOUTH DAKOTA

South Dakota reports no certification in LD. They also note that none is anticipated in the next three years. However, they list three schools that "may" have LD programs at the graduate or undergraduate level. They are the University of South Dakota (Vermillion), Northern State College (Aberdeen), and Augustana College (Sioux Falls).

TENNESSEE

Tennessee has not established requirements leading to certification, but they are planned for sometime during the next three years. The state has permitted the establishment of such programs and services in the local public school systems. Three institutions are establishing LD training programs. They are Peabody College for Teachers (Nashville), the University of Tennessee (Knoxville), and Memphis State University (Memphis).

TEXAS

Texas provides certification in the area of Language and/or Learning Disabilities (L/LD). They emphasize that their program in L/LD is offered on a limited basis and is undergoing a process of development and change. The standards for certification are considered interim and were adopted May 4, 1971. Further refinement and development should be expected. Currently 11 colleges and universities in Texas offer programs leading to certification in L/LD. Other institutions are in various stages of program development for state board approval.

UTAH

Utah has set certification standards for teachers in the area of learning disabilities as an endorsement to the Basic Professional or Professional Certificate issued by the State Board of Education. Five universities are listed as having the necessary programs, including the University of Utah (Salt Lake City), Southern Utah State College (Cedar City), Weber State College (Ogden), Brigham Young University (Provo), and Utah State University (Logan).

VERMONT

From Vermont the response is that certification in learning disabilities is necessary. However, a reading of the guidelines indicates endorsement for special education but not learning disabilities per se. The three colleges named are involved in the training of "special education teachers".

VIRGINIA

Virginia requires special endorsement for LD teachers. Required are nine semester hours of general special education, 12 hours of specific LD and six semester hours of related subjects. The schools offering appropriate programs are the University of Virginia (Charlottsville), Virginia Commonwealth University (Richmond) and Virginia Polytechnic Institute (Blacksburg).

WASHINGTON

Washington state does not have a special certificate for teachers in the learning disabilities area nor is it anticipated that a special certificate will be developed as a new program under the 1971 guidelines. It is anticipated that at least some of the teacher education institutions will develop programs in the LD area, but the teachers will receive a competency based certificate. Western Washington State College has been suggested as a contact for further information.

WEST VIRGINIA

The standards for West Virginia are being amended to include preparation of teachers in "special learning disabilities". The four institutions with the necessary programs are Glenville State College (Glenville), Marshall University (Huntington), West Liberty State College (West Liberty), and West Virginia University (Morgantown). The Kanawka Graduate School (Nitro) has also been suggested.

WISCONSIN

Wisconsin has established a minimum requirement for certification in learning disabilities. The applicant must be recommended by an approved university training program. The approved programs are presently at the three university campuses, the University of Wisconsin (Milwaukee, Madison and LaCrosse) and at Cardinal Stritch College (Milwaukee).

WYOMING

Wyoming provides for endorsement in the area of learning disabilities in addition to the B.A. degree. The University of Wyoming (Laramie) is the only institution which provides preparation in learning disabilities.

APPENDIX P

SELECTED BIBLIOGRAPHY ON
TRADITIONAL TREATMENTS

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with
Ernest Archambault

August 1972

The selections in this topic bibliography are limited to only those comprising the essence of the treatments considered to be representative of the most universally-accepted theories in the literature on learning disabilities.

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APPENDIX Q

DATA FROM PUBLISHING COMPANIES

Marsha Schubert

August 1972

The following table lists the publishers who responded to the materials survey, and presents those materials which they indicated to be useful in working with learning-disability students. The publishers' responses were examined for specific information: (a) Name and address of company; (b) Name of the item or set of materials (Please include the price); (c) Brief description of item or materials (Please include age of children for who it is designed and the type of deficit it is designed to remediate);and (d) Research validation for the materials (Please include name of researcher, title of research, description of children worked with, most important findings, and source where we can obtain more information about the research). All the data in the table comes only from the publishers' responses--no other sources were consulted.

The columns of the table include the following information:

1. The first column contains the names and addresses of the publishing companies.

2. The second column includes the names and the prices of specific materials. When the publisher sent a catalog, the data for the last four columns was collected from a random sampling of the materials in the catalog.

3. The third column lists the types of problems for which the materials were designed or for which they are advertised. The questionnaire requested information on materials for learning-disability students, but unless these materials were specifically advertised for learning-disability pupils or unless the publisher specifically stated they were for such students, they are not so indicated in this column.

4. The fourth column indicates the mental age (MA), the chronological age (CA), or the grade level for which the materials are intended.

5. The last column contains any research cited or supplied by the publishers in response to the questionnaire. When the publishers did not respond to this portion of the questionnaire or did not refer to any research, the statement "No research was indicated by the publisher," will appear in the column. When the company stated that there was no research done with its materials, the lack of research will be noted by the statement that there is no research available.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
American Educational Publications 245 Long Hill Road Middleton, Conn. 06457	Know Your World ($1.50/ 30 issues)	Problems in reading	CA 10-16	No research was done with LD population. The publisher indicated two formal surveys had been done (1969, 1971) which shows that the publication has a readability level of about 3.0 and that it is used with a wide range of problems.
American Guidance Service, Inc. Publisher's Building Circle Pines, Minn. 55014	Goldman-Lynch Sounds and Symbols Development Program ($117.00)	Speech	CA 4-9	No research was indicated by publisher
	Peabody Articulation Cards ($35.00)	Speech	Not Indicated	No research was indicated by publisher other than field testing on recognition of pictures.
	Peabody Language Development Kits -Level P ($153.00) -Level 1 ($ 51.00) -Level 2 ($ 70.00) -Level 3 ($ 54.00)	Disadvantaged Retarded		No research was done with LD population. The following research was cited by the publisher: Aserlind, L. Research: some implications for the classroom. Teaching Exceptional Children, 1969, 1, 42-54 Carter, J. L. The effects of a language stimulation program upon first grade educationally disadvantaged children. Education and Training Mentally Retarded, 1966, 1, 169-174 Cross, D. P. The effects of a systematic group language development program with low achieving and regular class third grade subjects. Unpublished doctoral dissertation. Lawrence, Kansas: University of Kansas, 1968.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
				Dunn, L. M. & Bruininks, R. H. The effectiveness of three reading approaches and an oral language stimulation program with disadvantaged children in the primary grades: A follow-up report after the third year. IMRID Papers and Reports, Vol. V, No. 13, Nashville, Tenn.: Peabody College, 1968.
				Dunn, L. M. & Bruininks, R. H. Efficacy of the Peabody Language Development Kits and the Initial Alphabet with Southern disadvantaged children in the primary grades: A follow up report after the fourth grade. IMRID Papers and Reports, Vol. V, No. 14, Nashville, Tenn.: Peabody College, 1968
				Dunn, L. M. & Mueller, M. Differential effects of the Peabody Language Development Kits on the ITPA profile. Nashville, Tenn.: Institute on Mental Retardation and Intellectual Development, Peabody College, 1967.
				Dunn, L. M. Neville, Pfost, P., Pochanart, P. & Bruininks, R. H. The effectiveness of three reading approaches and an oral language stimulation program with disadvantaged children in the primary grades: A final report after two years of the Cooperative Reading Project. IMRID Monograph #10, Nashville, Tenn.: Peabody College, 1968.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
				Dunn, L. M., Nitzman, M., Pochanart, P. & Bransky, M. Effectiveness of the Peabody Language Development Kits with educable mentally retarded children: A report after two and one-half years. IMRID Papers and Reports, Vol. V, No. 15 Nashville, Tenn.: Peabody, College, 1968.
				Dunn, L. M., Pochanart, P., Pfost, P. & Bruininks, R. H. The effectiveness of the Peabody Language Development Kits and the Initial Teaching Alphabet with disadvantaged children in the primary grades: A report after the third grade of the Cooperative Language Development Project. IMRID Monograph #9, Nashville, Tenn.: Peabody College, 1968.
				Ensminger, E. E. The effects of a classroom language development program on psycholinguistic abilities and intellectual functioning in slow-learning and borderline retarded children. Unpublished doctoral dissertation. Lawrence. Kansas: University of Kansas, 1966.
				Forgnone, C. Effects of group training in visual perception and language development upon the visual perception and language development upon the visual perception and psycholinguistic abilities of retarded children. Unpublished doctoral dissertation. Nashville, Tenn.: Peabody College, 1966.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
				Gibson, R. C. Effectiveness of a supplemental language development program with educable mentally retarded children. Unpublished doctoral dissertation, Iowa City, Iowa: University of Iowa, 1966.
				Horton, Kathryn B. & McConnell, Freeman E. Language characteristics of culturally deprived children. Paper read at American Speech and Hearing Association, Washington, D.C., November, 1966.
				Keehner, E. A comparative study of linguistic and mental abilities before and after a development-remedial language program with mentally retarded children. Unpublished master thesis, Madison, Wisc.: University of Wisconsin, 1966.
				McConnell, F., Horton, K. B. & Smith, B. R. Language development and cultural disadvantagement. Exceptional Children, 1969, 35, 597-606.
				Milligan, J. L. A study of the effects of a group language development program upon the psycholinguistic abilities of kindergarten children. Unpublished doctoral dissertation. Lawrence, Kansas.: University of Kansas, 1966.
				Morris, Susan. A study of the effects of nine months of PLDK-P training on the Stanford Binet (L-M) Scale, PPVT and ITPA performance of five-year-old culturally disadvantaged children. Nashville, Tenn.: Vanderbilt University (in preparation).

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
				Mueller, M. & Smith, J. O. The stability of language modifications over time. American Journal of Mental Deficiency. 1964, 68, 537-539. Smith, Carolyn M. Development of a revised experimental kit for oral language stimulation. Unpublished Ed.S. thesis. Nashville, Tenn.: George Peabody College for Teachers, 1964. Smith, J. O. Effects of a group language development program upon the psycholinguistic abilities of educable mental retardates. Peabody College Research Monograph Series in Special Education. No. 1. Nashville, Tenn.: George Peabody College for Teachers, 1962. (Available from the Peabody College Bookstore). Smith, J. O. Generating language development lessons from theoretical bases. In Special Education: Strategies for Progress. Washington, D.C., N.E.A. Council for Exceptional Children, 1966. Stearns, K. E. Experimental group language development for psychosocially deprived preschool children. Unpublished doctoral dissertation. Bloomington, Indiana.: Indiana University, 1966.
	Peabody Rebus Reading Program (varies)	beginning or remedial readers	Not Indicated	No research was done with an LD population. The following research was cited in connection with the Rebus materials:

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
				Woodcock, Richard W. The Peabody-Chicago-Detroit Reading Project--A Report of the Second-Year Results, in J. R. Block (Ed.), i.t.a. as a Language Arts Medium. Hempstead: i.t.a. Foundation, Hofstra University, 1968. Woodcock, R. W. Rebuses as a Medium in Beginning Reading Instruction, IMRID Papers and Reports, 1968, 5. Woodcock, R. W., Clark, C. R. and Davies, C. J. The Peabody Rebus Reading Program. Circle Pines, Minn.: American Guidance Service, 1969.
Ann Arbor Publishers 611 Church Street Ann Arbor, Mich. 48104	Michigan Language Program (Price unknown)	ESL, Adult ED., Job Care	CA 3 up	No research was indicated by publisher.
	Michigan Tracking Program (Price unknown)			No research was indicated by publisher.
	Cues and Signals (Price Unknown)			No research was indicated by publisher.
	Kinder-Fun ($8.50/set)	Not Indicated	Kindergarten	No research was indicated by publisher.
	Images of the USA ($3.50/ea.)	Not Indicated	High School	No research was indicated by publisher.
Appleton-Century-Crafts New Century 440 Park Avenue New York, New York 10016	Trip to the Moon ($96.00)	LD	Pre-school, 1st Grade	No research is available.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
	Puzzle Pyramid ($48.00)	LD	Pre-school, 1st Grade	No research is available.
	Perceptual Learning Puzzles ($48.00)	LD	Pre-school, 1st Grade	No research is available
	Matrix Games ($58.00)	LD	Pre-school, 1st Grade	No research is available.
	Listen, Mark and Say ($96.00)	LD	Pre-school, 1st Grade	No research is available
	Language Lotto ($48.50)	LD	Pre-school, 1st Grade	No research is available
	Color Rhyming Lotto ($33.00)	LD	Pre-school, 1st Grade	No research is available
Bantam Books, Inc. School and College Division 666 Fifth Avenue New York, New York 10019	Catalog of high interest level/low reading level books. (varies)	Remedial reading	Varies	No research was indicated by publisher

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
Behavioral Research Laboratories P. O. Box 577 Palo Alto, CA 94302	Sullivan Basal Math ($41.16)	Not Indicated	Not Indicated	For Information about research regarding these materials, the publisher referred us to: Sullivan Associates Palo Alto, California 94302
	Sullivan Reading ($39.00)	Not Indicated	Not Indicated	
	Sullivan Academic Readiness Curriculum ($499.95)	Not Indicated	Not Indicated	
Bell and Howell Audio Visual Products Division 7100 McCormick Road Chicago, Ill. 60645 461	Language Master and Programs (Lang. Master only—$250.00) Also sent catalogue and fliers on other AV equipment	All, including LD	All	No research was indicated by publisher.
Benefic Press 10300 W. Roosevelt Rd. Westchester, Ill. 60153	Publisher sent catalog of materials and programs (varies)	Not Indicated	All	No research was indicated by publisher.
Borg-Warner Educational Systems 7450 N. Natchez Ave. Niles, Ill. 60648	System 80 Audio Visual Unit, kits, and related materials and equipment (varies)	Not Indicated	K-4th Grade	No research was done with LD population. The following study was supplied by the publisher: Summary Report of the effect of System 80 Learning Programs in two Chicago Public Schools. Niles, Ill.: Borg-Warner Educational Systems, 1971.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
Bowmar 622 Rodier Drive Glendale, California 91201	Publisher sent catalog of books and other materials.	All except LD	All	No research was indicated by the publisher.
CCM Threshold Learning, Inc. Division of the MacMillan Co 866 Third Avenue New York, New York 10022	Threshold Learning Abilities (checklist & manual--$14.95) For Use with Threshold Early Learning Library ($20.85)	Average Group, LD	CA 3-7	No research was indicated by the publisher.
Continental Press, Inc. Elizabethtown, Pa. 17022	Arithmetic-Step by Step Kit A ($59.50)	Slow Learners	K-3 Grade	No research is available
	Arithmetic-Step by Step Kit B ($59.50)	Slow Learners	3-6 Grade	No research is available
	Reading Readiness Series ($81.50 for entire set)	Slow Learners	K and Primary	No research is available
	Special Education Series ($52.50)	Slow Learners	Pre-school through early Intermediate	No research is available
Cuisenaire Company of America, Inc. 12 Church Street New Rochelle, New York 10885	Publisher sent catalog of materials.	Not Indicated	Not Indicated	No research was done with LD population.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
				The following research was cited by the publisher: Aurich, Sister M. Richard. A comparative study to determine the effectiveness of the cuisenaire method of arithmetic instructions with children at the first grade level. Washington, D.C.: Catholic University of America, 1963. Beard, Karen D. An intensive study of the development of mathematical concepts through the cuisenaire method in three-year olds. New Haven, Connecticut: Southern Connecticut State College, 1964. Buckley, Patricia C. A study of arithmetic achievement of a group of fourth grade children who have studied the cuisenaire program at Kinnelon. *The New Jersey Mathematics Teacher*, January, 1965. Callahan, J. J. and Jacobson, Ruth S. An experiment with retarded children and cuisenaire rods. *The Arithmetic Teacher*, 1967, XIV, 10-13. Canadian Council for Research in Education. Canadian experiences with the cuisenaire method. Canada, 1964. Cooke, Davies-Nora. A realm of rods. *New Education*, England (nd), II, 6 & 7.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
				Excoffier, E. *La methode cuisenaire-gattegno des nombres en coleurs, experiences realisees en 2^{e} et 3^{e} anees primaires*. Neuchatel: Delachaux et Niestle, 1961 Gagnon, R, and others. Etude comparative--methode cuisenaire--methode traditionnelle. Canada, 1964. Hayes, J. Cuisenaire rods and the teaching of multiplication to third grade children. Unpublished doctoral dissertation. Tallahassee: Florida State University, 1963. Hinchcliffe, Ivy. A report on an experiment to evaluate the effectiveness of two different methods of teaching arithmetic in grade 1. Unpublished M.Ed. thesis. Winnipeg, Canada: University of Manitoba, 1961. Hollis, Loye Y. A study to compare the effects of teaching first and second grade mathematics by the cuisenaire-gattegno method with a traditional method. *Dissertation Abstracts*, 1965, XXVI, 905-906. Hopkins, J. A study of the use of the cusienaire method of teaching arithmetic as a remedial method with two educationally retarded, emotionally disturbed children. Unpublished M.Ed. thesis. Raleigh: North Carolina State University at Raleigh, 1966.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
				Karatzinas, D. and Renshaw, T. Teachers' view of the cuisenaire method. Scottish Educational Journal, 1958, 575.
				Karatzinas, D. and Renshaw, T. Teachers' view of the cuisenaire method. Scottish Educational Journal, 1958, 595.
				Karatzinas, D. and Renshaw, T. Testing the effectiveness of the cuisenaire material. Scottish Educational Journal, 1958, 613.
				Keislar, E. R. Abilities of first grade pupils to learn mathematics in terms of algebraic structures by teaching machines. Los Angeles: University of California at Los Angeles, 1961.
				Lucow, W. H. Cuisenaire method compared with current methods of teaching multiplication and division in grade III. Winnipeg, Canada: The Manitoba Teachers Society, 1962.
				Orans, Sylvian Kornreich. The cuisenaire rods in arithmetic instruction for seven second grade children. New York: Queens College of the City University of New York, 1963.
				Root, T. One school's experience with cuisenaire-gattegno mathematics instruction. New York State Mathematics Teachers Journal, XIII, 1, 1963.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
				Saskatchewan Teachers' Federation. Cuisenaire: A sound approach to teaching mathematics. Saskatoon, Canada, 1960. Saskatchewan Teachers' Federation. Report on the cuisenaire method of teaching mathematics as used in Saskatchewan 1962. Saskatoon, Canada, 1962. Sweeney, J. R. An experimental study of teaching a grade one course in mathematics using the cuisenaire methods and materials compared with traditional methods and materials. Kitchener, Ontario: Kitchener Separate School Board, 1964.
Developmental Learning Materials 3505 N. Ashland Chicago, Ill. 60657	Publishers sent catalog of materials	LD	Not Indicated	No research is currently available, but testing is being done at Cove School, Evanston, Illinois, under the direction of Dr. Lehtinen's Program.
Dick Blick Co. P. O. Box 1267 Route 150 E Galesburg, Ill. 61401	Dressing Frames ($4.90)	Not Indicated	Not Indicated	No research is available
	Puzzle Block ($3.90)	Not Indicated	Not Indicated	No research is available
	Threader ($3.40)	Not Indicated	Not Indicated	No research is available
	Publisher also sent two catalogs of materials.	Not Indicated	Not Indicated	No research is available

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
Economy Company P. O. Box 25308 Oklahoma City, Okla. 73125	Pacer ($89.25)	LD	Not Indicated	No research is available
	Pacerecorder ($375.00)	LD	Not Indicated	No research is available
	Sounds and Stories ($165.00)	Slow Learner, LD	Not Indicated	No research is available
	Countdown ($198.00)	LD	1-3 Grade	No research is available
	Base ($120.00) (Pupil's book--$1.53)	LD	Intermediate & Older	No research is available
	Spacetalk ($165.00)	Poor Readers, Speech, LD	K-2 Grades, remedial programs	No research is available
	Ears ($81.00) (Pupil's book--$1.80)	LD	Pre school, K and primary grades	No research is available
	Publisher also sent catalog of books	Not Indicated	Grade levels given	No research was indicated by the publisher
Educational Activities, Inc. 4067 Transport Street Palo Alto, Calif. 94302	Publisher sent catalog	Not Indicated	Grade levels given	No research was indicated by the publisher

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
Educational Developmental Laboratories Division of McGraw-Hill 284 Pulaski Huntington, New York 11744	Learning 100 ($1,500.00 to $5,000.00)	culturally disadvantaged, LD	Secondary, Adult	No research cited by the publisher.
	Listen, Look, Learn ($1,500.00 to $5,000.00)	culturally disadvantaged, LD	K-6 Grade	Charleton, Bette, "Acceptance Plus Structure Yields Learning," Exceptional Children, 1970 (summer 1970) 36, 763-765. This study is concerned with the effectiveness of LLL with three boys diagnosed as minimally brain injured. Coghill, Charles, "An Achievement Report on a Listen, Look Learn Project at the Villa Solano State School," Huntington, N.Y., Educational Development Laboratories, Inc. Brickner, Ann, Elaine Scheier, and Donald R. Senter, Evaluation of Listen Look Learn Cycles R-40 in Corrective and Remedial Installations, 1967-68. Huntington, N.Y.: Educational Laboratories, Inc., 1969. This book contains the results of seven studies done in a variety of educational settings and with several different types of student populations.
Educational Projections Corp. 527 S. Commerce St. Jackson, Mississippi 39205	Pre-Vocational Guidance Program (28 filmstrips @ $10.00 ea.)	Under-Achievers, Sheltered workshop placements, LD	4th Grade Reading Level	No research was indicated by the publisher

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
	Reading Readiness Program ($360.00 for filmstrips) (Above programs need viewer $125.00)	visual perception, LD	Any	No research was done with LD population. The University of South Florida is tabulating results obtained from research in several schools in Florida (Cooperative Research Project #1267).
	Multi-Sensory Kits (Eleven @ $100.00 ea.)	Retarded and Slow Learners	5-6 Grades	No research was indicated by the publisher.
EduKaid of Ridgewood 1250 E. Ridgewood Ave. Ridgewood, N. J. 07450	Publisher sent catalog	Normal Kids	Not Indicated	No research was indicated by the publisher.
Electronic Futures, Inc. 57 Dodge Avenue North Haven, Conn. 06473	Auditory Perception ($159.00)	Auditorally disabled, LD	K-6 Grades	No research was indicated by the publisher.
	Intermediate Auditory Perception ($159.00)	Auditorally disabled, LD	4-6 Grades	No research was indicated by the publisher.
	Accent on English Program ($380.00)	English as a second lang. (Spanish Speaking)	CA 6-8	No research was indicated by the publisher.
	Object Recognition Series ($320.00)	Not Indicated	Elementary Grades	No research was indicated by the publisher.
	Reading Readiness Program ($660.00)	Not Indicated	Early Primary Grades	No research was indicated by the publisher.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
	Self-Instructional Basic Mathematics ($1,064.00)	Children with Math Problems	K-6 Grades	No research was indicated by the publisher.
	Patterns in Phonics ($700.00)	Not Indicated	K-3 Grades	No research was indicated by the publisher.
	Special Language Program ($164.00)	Verbally Disadvantaged	Early Primary	No research was indicated by the publisher.
	Most of the above materials to be used with the audio flashcard reader ($250.00 or $270.00)			
Fearon Publishing Co. 6 David Drive Belmont, Calif. 94002	Pacemaker Arithmetic Readiness Program ($93.00)	EMR	1-2 Grades	No research is available.
	Pacemaker Games Program ($36.00)	Not Indicated	Not Indicated	No research is available.
	Pacemaker True Stories (.85 each)	EMR, Slow Learners, Reluctant Readers	7-12 Grades; Reading Ability Level 2-2.5	No research is available.
	Adventures in Space (.85 each)	EMR, Slow Learners, Reluctant Readers	7-10 Grades; Reading Level 2.5-3.5	No research is available.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
	Pacemaker Classics ($1.75 ea.)	EMR, Slow Learners, Reluctant Readers	7-12 Grades; Reading Level 2.0	No research is available.
	Pacemaker Story Books ($1.00 ea.)	EMR, Slow Learners	7-12 Grades; Reading Level 1.9-2.6	No research is available.
	Pacemaker Text Workbooks ($1.50 to $2.00 ea.)	EMR, Slow Learners, Reluctant Readers	7-12 Grades; Reading Level 2.2-3.6	No research is available.
	Publisher also sent catalog	EMR, Slow Learners, Culturally Disadvantaged Reluctant Readers	Reading Level Indicated on Books in Sp. Ed.	No research was indicated by the publisher.
Gameco Industries, Inc. Perceptual Development Labs P. O. Box 1911 Big Springs, Texas 79720	Publisher sent catalog	Not Indicated (Normal)	Jr. High to College Soph. Level	No research was indicated by the publisher.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
Garrard Publishing Company Champaign, Illinois 61820	Publisher sent catalog	Not Indicated	In Catalog	No research was indicated by the publisher,
General Learning Corporation Media Division Morristown, N. J. 07960	Publisher sent catalogs (Includes INVICTA, Judy, SIFO, and Visiometics materials)	Not Indicated	In Catalog	No research was indicated by the publisher.
Hammond, Inc. Educational Sales Department 330 W. 42nd Street New York, N. Y. 10036	Publisher sent catalog	Not Indicated	Not Indicated	No research was indicated by the publisher.
Holt, Rinehart, and Winston, Inc. 383 Madison Avenue New York, N. Y. 10017	Publisher sent catalog	Not Indicated	Grade Levels Indicated	None Indicated
i/t/a Publications, Inc. 6 East 43rd Street New York, N. Y. 10017	Early to Read Series (Price varies with selection of materials, supplementary materials and books, and quantity)	Remedial Reading, Normal	Beginning Readers	No research with LD population was indicated by publisher. The publisher sent press releases, articles, and other papers which clearly state that research has been done, but the company gives no references.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
	Downing Readers and Supplementary materials (price varies with selection of materials and quantity)	Remedial Reading, Normal	Beginning Readers	The publisher writes that more information is available on request from their office or the i.t.a. Foundation. Hofstra Univeristy Hempstead, New York 11550
	Breakthrough (price varies as above)	Remedial Reading, Language	Adults	
Ideal School Supply Co. 11000 S. Lavergne Avenue Oak Lawn, Ill. 60453	Publisher sent catalog	Not Indicated	All Ages	No research was indicated by the publisher.
Imperial International Learning Corporation Box 548 Kankakee, Illinois 60901	Publisher sent catalog	Not Indicated	In Catalog	No research was indicated by the publisher.
Instructor Publications, In 7 Bank Street Dansville, N. Y. 14437	Early Concepts Series (8 sets at $2.25 ea.)	Not Indicated	Not Indicated	No research was indicated by the publisher.
	Picto-word Flash Cards ($3.00)	Not Indicated	Not Indicated	No research was indicated by the publisher.
	Picto-Lotto Cards ($3.00)	Not Indicated	Not Indicated	No research was indicated by the publisher.
	Perceptual Concepts Series ($5.00)	Not Indicated	Not Indicated	No research was indicated by the publisher.
	Mother Goose Rhymes ($2.00)	Not Indicated	Not Indicated	No research was indicated by the publisher.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
	Everyday Pictures ($2.25)	Not Indicated	Not Indicated	No research was indicated by the publisher.
	Publisher also sent catalog.	Not Indicated	Not Indicated	No research was indicated by the publisher.
Learning Research Assoc., Inc. 1501 Broadway New York, N. Y. 10036	Michigan Language Program ($675.00) Publisher also sent catalog.	Nonreaders, LD	All Ages	For research, the publisher advises us to contact Dr. Donald E. P. Smith (No address given).
Learning Through Seeing LTS Building, Box 368 Sunland, Calif. 91040	Tachist-o-films (price varies with selection)	Average, Remedial, or Superior Students	Grade Levels Given	Publisher indicates that there is research validation for these materials and that such research is included with each film set.
	Viewtach ($59.50)			
	Tachisto-flashers ($14.50)			
	Protach ($99.50)			
Mafix Associates 11 Barron Avenue Johnstown, Pa. 15906	Publisher sent catalog	Special Ed. Students	Not Indicated	Publisher writes that all materials have been researched (at least in field tests), but cites no references.
McGraw-Hill Book Company Webster Division Manchester Road Manchester, Missouri	Learning Skills Services (Four books at $2.58 ea., Manual, $3.60)	EMR's	Teenager	No research was indicated by the publisher

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
	Sullivan Programmed math (varies with selection and quantity desired)	Not Indicated	3-5 Grades or Remedial Grades 6-9	No research was indicated by the publisher.
	Elementary Science Study Units (varies with selection of material)	Not Indicated	Not Indicated	No research was indicated by the publisher.
	Publisher sent catalog	Areas Indicated	Grade Levels Given	No research was indicated by the publisher.
Milton Bradley Company East Longmeadow, Mass. 01028	Early Childhood Enrichment Units (Varies with each unit)	Not Indicated	Pre-school K-1 Grades	No research was indicated by the publisher.
	Suggested aids for educating the pre-academic exceptional child (a catalog)	All other areas, except LD	Pre-school	Publisher indicates that material research was in cooperation with the Gengras Clinic for Exceptional Children, St. Joseph College, West Hartford, Conn.
	Publisher also sent catalogs	Not Indicated	Not Indicated	No research was indicated by the publisher.
Noble and Noble Publishers 750 Third Avenue New York, N. Y. 10017	TRY: Experiences for Young Children ($23.25)	Not Indicated	MA 4-7	No research was done with an LD population. The publisher indicates that field testing was done to determine effectiveness and appropriateness of the materials.
	Publisher also sent catalog	Not Indicated	Grade Levels Given	No research was indicated by the publisher.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
Open Court Publishing Co. Box 599 La Salle, Illinois 61301	Open Court Kindergarten Program (price varies with selection and quantity of materials)	Not Indicated	Kindergarten	No research has been done on Open Court materials with LD population. Effects of the Open Court Reading Program on Achievement in Grade Four, Newport News, Virginia: 1970. Reprinted by publisher. Also asked to contact: Mr. Harry J. Burgener Director of Special Education Cahokia Area Special Education 1700 Jerome Lane Cahokia, Illinois
	Special Education Program ($303.75)	EMR's	1st yr. of reading	
	Remedial Reading Program ($42.00)	Reading Problems	Grade 4 and up	Publisher indicated that research was done with this program, and that results were favorable, but cites no source.
	Publisher sent catalog			
J. A. Preston, Corp. 71 5th Avenue New York, N. Y. 10003	Publisher sent catalog	Exceptional Children	Not Indicated	Publisher did not indicate any research.
Psychotechnics, Inc. 1900 Pickwick Avenue Glenview, Ill. 60025	Reading Program ($799.00)	Normal and Remedial	K-4 Grades and 2-8 Grades	Research done by Eldon Ekwall and Lowell Oswald. No further information given.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
	Tachomatic 500 ($325.00)	Not Indicated		No research was indicated by the publisher specifically for this product.
	Radio Reading Series ($525.00)	Not Indicated	Intermediate to Adult	No research was indicated specifically for the product.
	Shadowscope Reading Pacer ($94.00)	Not Indicated	Not Indicated	No research was indicated specifically for this product.
	T-matic ($119.50)	Not Indicated	Not Indicated	No research was indicated specifically for this product. No research on Psychotechnics materials was done with an LD population. General research supplied by publisher: The development of the Optimum Reading Achievement Concept and Program of Secondary Reading Instruction. Master's Thesis by Walter L. Powers. Butler University, Indianapolis, Indiana (June, 1967). TSC Reading Center Tops in State--USA. Too! Reprinted from the Tropolitan (Friday, Oct. 6, 1967) by Psychotechnics. Clair Bliker, Southern State College Developmental Reading Program During Fall Semester 1965-1966, Psychotechnics Bulletin 102.
Reading Institute, Inc. 116 Newburg Street Boston, Mass. 02116	Pocket-Tac ($5.96 with three tapes, .50 ea. additional tape)	Not Indicated	Reading Grades 1-6 and Math Grades 1-12	No research was indicated by the publisher.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
Rheem Califone Rheem Manufacturing Co. 5922 Bowcraft Street Los Angeles, Calif. 90016	Remedial Reading Laboratory (price varies with selection of materials)	Reading Problems	In Catalog	No research was specifically cited by the publisher.
	Percepta-matic Reading Series Materials ($35.25 each level)	Not Indicated	Reading Levels 1-8 (one i. t.a.)	No research was indicated by the publisher.
	Rheem-T-Scope ($135.00)	Not Indicated		No research was indicated by the publisher.
Scholastic Magazines, Inc. 50 West 44th Street New York, N. Y. 10036	ACTION Unit ($87.75) ACTION Library ($30.00) ACTION Word Attack Supplement ($7.50)	Low in Reading	2-4 Grade Level for Secon.	No research was done with LD population Lackey, George H., Jr., and Stratler, Charles R., A Field Evaluation of the Scholastic ACTION Program.
	Publisher also sent catalog	Reading Problems, normal	Grade Levels Given	No research is indicated by the publisher.
Scott, Foresman & Co. 2000 East Lake Avenue Glenview, Illinois 60028	Publisher sent catalog	Special Learning problems	Not Indicated	No research is indicated by the publisher.
Steck-Vaughn Company P. O. Box 2028 Austin, Texas 78767	Puzzles and Patterns (.81)	Mentally Handicapped, LD	Not Indicated	No research was done with an LD population. Matt J. Flavach and Donovan Stoner did pre-publication testing. No other details were given.
	Read Better with Jim King (.81)	LD, Emotional	2-3 Reading Levels for teenagers	No research is indicated by the publisher.

Publisher	Materials (Cost)	Specified Problems	Grade or Age Level	Research Indicated by the Publishing Company
Teaching Resources 100 Boylston Street Boston, Mass. 02116	Publisher sent catalog	LD, Poor reading skills, others	In Catalog	No research is indicated by the publisher.
Visual Needs, Inc. 135 State Street Rochester, N. Y. 14614	Parquetry Blocks with Templates (consultant's kit - $95.00) (basic kit - $44.00)	Slow Learners and other Learning Problems	Kindergarten, Primary Grades, Special Classes	No research is indicated by the publisher.
George Wahr Publishing Co. 316 South State Street Ann Arbor, Mich. 48108	Remedial Reading Drills (Hegge, Kirk & Kirk) ($2.00)	Reading Disability	Below 4th Grade Reading Level	No research is indicated by the publisher.
Zaner-Bloser Company 612 North Park Street Columbus, Ohio 43215	Trac-A-Bit ($2.46)	Not Indicated	Not Indicated	No research is indicated by the publisher.
	Perception Strips ($1.75)	Not Indicated	Not Indicated	No research was indicated by the publisher.
	Writing Frames ($1.00)	Not Indicated	Not Indicated	No research was indicated by the publisher.
	I Can Do Series ($1.80--workbook, $1.00--manual)	Some for children with Special needs.	MA 3-9	No research is indicated by the publisher.
	Publisher sent catalog	Some for Special Education students	Grade Levels Given Sometimes	No research is indicated by the publisher.

APPENDIX R

DATA FROM DCLD SURVEY OF MATERIALS

Rena Lewis

August 1972

The techniques and materials named by DCLD members are organized under 15 categories: auditory perception; behavior management; miscellaneous; games; general tests; general texts, methods, and authors; language development; motor training; remedial math; remedial reading; social skills; spelling; thinking skills; visual perception; and writing. Those materials which were mentioned 20 times or more were considered to be favorite materials and are indicated by an asterisk.

Auditory Perception

Definition: Materials included under this heading are those which use auditorily-presented material and which attempt to train auditory discrimination, auditory memory, auditory closure, sound blending, listening comprehension, or other auditory abilities.

	Materials	Responses
1.	Accustafones	1
2.	Allen--Guide for Auditory Perceptual Training	1
3.	Aud-X	1
4.	Audio-Flash	3
5.	Audio Tapes and Worksheets	2
6.	Auditory Discrimination Game	1
7.	Auditory Discrimination Training	2
8.	Auditory Perception Training	1
9.	Auditory Retention Cards	1
10.	Auditory Stimulator--Workbooks by J. Kaplan	3
11.	Auditory Stimulators--de Hirsch	1
12.	Auditory Training Activities	1
13.	Auditory Training Records	1
14.	Categorical Sounds System	1
15.	Childhood Rhythm Records	1
16.	Collection of Things that Made Sounds	1
17.	*Developmental Learning Materials	29

*20 or more responses

18.	DLM Buzzer Board	14
19.	DLM Auditory Discrimination Tapes	7
20.	DLM Auditory Memory Tapes	2
21.	DLM Auditory Perception Kits	9
22.	DLM Auditory Perception Tapes	6
23.	Developmental Systems for Structuring Listening Behavior	1
24.	EDL Tapes	2
25.	Flowers-Costello Test of Central Auditory Abilities	1
26.	Henderson Sound Program	1
27.	Herr Auditory Training Program	3
28.	Herr Perceptual Communication Skills	2
29.	Ideal Memory Tapes	1
30.	Ideal--Objects that Rhyme	1
31.	Imperial Auditory Discrimination Cassettes	1
32.	Informal Sound Discrimination Exercises	1
33.	Listen and Think Series (EDL)	2
34.	Listen, Look, Learn	1
35.	Listen, Mark, and Say Tapes	2
36.	Listening Center	1
37.	Listening and Learning (Houghton Mifflin)	2
38.	Listening Games	2
39.	Listening Post	3
40.	Listen, Write, and Speak (Scott Foresman)	1
41.	Michigan Language Listening Material	1
42.	My Sound Book	1
43.	Oakland and William--Auditory Perception	1

44. Oral Direction Games	1
45. Patterns, Sounds, and Meaning Series	1
46. Sound Boxes	1
47. Sound Clown	1
48. Sound Effects	1
49. Sound I Can Hear	1
50. SOS Program (Sound, Order, Sense)--Semel	13
51. SRA Auditory Discrimination Tapes	1
52. SRA Listening Tapes and Activities	2
53. Teaching Resources--Auditory Discrimination in Depth	17
54. Teaching Resources--Auditory Perception	1
55. Wepman Auditory Discrimination Test	3
56. Wollensak Tapes--Listen and Do	4
57. Zedler--Listening for Speech Sounds	1
58. Zoneff--Hearing and Listening Book	1
	169

Behavior Management

Definition: Techniques included under this heading are those which attempt to manage, modify, or control behavior.

Materials	Responses
1. Acceptance, Love, Care, and Understanding	1
2. Affective Learning Environment	1
3. *Behavior Modification	30
4. Carrels	3
5. Check Expression and Reinforce	1
6. Check Reception and Reinforce	1
7. Contingency Management	2
8. Dreikers-Adler Philosophy	1
9. Engineered Classroom-Hewett	3
10. Immediate Feedback	1
11. Individual Areas for Quiet	1
12. Modeling	1
13. Operant Conditioning	1
14. Play Therapy	1
15. Point Reward System	1
16. Positive Reinforcement, Rewards	6
17. Praise	1
18. Precision Teaching	6
19. Prescription Contracting	1
20. Reality Therapy Class Meetings	1
21. Selected Stress	1
22. Student-Teacher Contracts	3
23. Token System	3
	71

*20 or more responses

Games

Definition: Materials included under this heading are designated as games and do not fit under any one other category. (Those games that fit under another category are listed there, e.g., "math games" are listed under "Remedial Math.")

	Materials	Responses
1.	Anagrams	1
2.	Animal Rummy	1
3.	Bingo Game (Homemade)	1
4.	Card Games	6
5.	Checkers	1
6.	Cinci-Cards	1
7.	Codes	1
8.	Concentration Games	3
9.	Doghouse Game	1
10.	Dominoes	4
11.	Flinch Cards	1
12.	Games	15
13.	HI-Q	1
14.	Kenworthy Games	1
15.	Learning Games	1
16.	Learning Games Kit (Lyons and Carnahan)	1
17.	Lotto Games	2
18.	Memory Game	2
19.	Musical Games	1
20.	Perquackey	1
21.	Quizmo	1
22.	SRA Games	1

23.	Teacher-Made Games	5
24.	Tic-Tac-Toe Games	1
		54

General Tests

Definition: Materials included under this heading are tests (diagnostic or instruments) which do not fit under another one category. (Those tests which fit under another category are listed there, e.g., the "Frostig Developmental Test of Visual Perception" is listed under "Visual Perception".)

	Material	Responses
1.	Basic Educational Skills Inventory	1
2.	Bender Test	1
3.	Binet	1
4.	Children's Apperception Test (CAT)	1
5.	Detroit Tests of Learning Aptitude	1
6.	Developmental Scales	1
7.	Diagnosis and Achievement Tests	1
8.	Hereward Observation Test	1
9.	Metropolitan Achievement Test	1
10.	Paper and Pencil Tests	1
11.	Slossen Intelligence Test	3
12.	Southern California Battery	1
13.	Star Test for Academic Readiness	1
14.	Thematic Apperception Test (TAT)	1
15.	Teacher-Made Diagnostic Instruments	1
16.	Wechsler (WIPPSI, WISC, WAIS)	8
17.	Wide Range Achievement Test (WRAT)	3
		28

General Texts, Methods, and Authors

Definition: Included under this heading are names of individuals, books, and methods which are general or obscure references and which do not fit under any other category.

	Materials	Responses
1.	Becker--Parents Are Teachers	1
2.	Cruickshank Methods	4
3.	Curriculum Guide for Children and Youth with Special Needs (Maryland State Department of Education, 1958)	1
4.	Farrald--A Remediation Handbook for Children with Reading Disabilities	3
5.	Goldstein and Levitt	2
6.	Kottmeyer	1
7.	McCarthy and McCarthy--Learning Disabilities	2
8.	Myers and Hammill--Methods for Learning Disorders	1
9.	Minimal Brain Dysfunction in Children (HEW--3 Phases)	1
10.	Mooney	1
11.	Rey	1
12.	Santucci	1
13.	Stamback	1
14.	Straub--Educational Therapy	1
15.	Van Busch	1
16.	Zazzo	1
		23

Language Development

Definition: Materials included under this heading are those which stimulate vocabulary development and expressive language (written or oral) or which teach labels, grammar, or simple concepts.

Materials	Responses
1. Autosort Language Arts Program (Bell and Howell)	1
2. Bangs--Language and Learning Disabilities of the Preacademic Child	2
3. Basic English Sentence patterns	1
4. Bereiter and Engelmann--Teaching Disadvantaged Children	2
5. Botel Language Test	1
6. Bricker--Language Development Procedures	1
7. Bush and Giles--Aids to Psycholinguistic Teaching	13
8. Communication Skills	1
9. DLM Language Materials	1
10. Discovering Opposites	1
11. Distar Language	6
12. Engelmann Techniques	3
13. Edgington Language and Phonics Test	1
14. Enjoying English (Random House)	1
15. Fitzgerald Key (Modified)	2
16. Fun with Rhymes	1
17. Generative-Transformational Grammar--Reddell	1
18. *Illinois Test of Psycholinguist Abilities (ITPA)	27
19. Imperial Cassette Programs in Language	1
20. Johnson and Myklebust--Learning Disabilities	8
21. Karnes--Developing Language Skills in Young Children	8

*20 or more responses

22.	Kirk and Kirk--Psycholinguistic Learning Disabilities: Diagnosis and Remediation	3
23.	Laidlaw English Workbooks	1
24.	Lancaster--Introducing English	1
25.	Language Development	1
26.	Language Feed-In Model	1
27.	Language Lotto	3
28.	Language Pattern Drills	2
29.	Laura Lee (NSSD)	1
30.	Manipulative Language Arts--Ellis	1
31.	Matt Adult Education Program in Language Arts	1
32.	McGinnis Technique	2
33.	McLeod Exercises	1
34.	Michigan Language Program	9
35.	Monterrey Language	1
36.	Mott Basic Language Series	2
37.	*Peabody Language Development Kit	76
38.	Peabody Picture Vocabulary Test (PPVT)	3
39.	Programmed English Grammar	1
40.	Psycholinguistic Books and Pamphlets	1
41.	Pugh Language Program	1
42.	Resource Guide for ITPA	1
43.	Rhyming Objects, Rhyming Puzzles	2
44.	Rotter Incomplete Sentences	1
45.	Scope Language Skills	1
46.	Scott Foresman--Writing Our Language	1
47.	Scrabble	1
48.	Sentence Repetition	1

*20 or more responses

49.	Silly Sentences	1
50.	Snoopy Code Book	1
51.	Solving Language Difficulties--Steere, Kah, Peck	1
52.	SRA Word Games	2
53.	SVE--Using Good English	
54.	Tok Bak	4
55.	Talking Books, Talking Page	11
56.	Telephone Kit	1
57.	*Valett--Remediation of Learning Disabilities	35
58.	Vocabulary Words	1
59.	Word and Sentence Games	1
60.	Word Blocks	1
61.	World of Language Book	1
		263

*20 or more responses

Miscellaneous

Definition: Materials included under this heading are general, obscure, or ambiguous materials which do not fit under any other category.

	Materials	Responses
1.	A-Blocks and People Pieces	1
2.	Accommodative Rock	1
3.	Acetate (Wall Size)	1
4.	Advantage Workbook	1
5.	Art Materials, Arts and Crafts	2
6.	Audio-Visual Materials	2
7.	Baseline Learning Systems--Ken Hill (Unpublished)	1
8.	Belgan Exercises	1
9.	Bemner Do Charts	1
10.	Benner Troubleshooter	1
11.	Calendars	2
12.	Cans	1
13.	Caramels	1
14.	Cardboard Tubes	1
15.	Caroms	1
16.	Carousel Library	1
17.	Carpentry	1
18.	Cartoons	1
19.	Cassette Tapes and Tape Recorders	16
20.	Cellograph Visual Aids	1
21.	*Chalk, Chalkboard, Chalkboard Writing	29
22.	Charts	1
23.	Cheiroscope	1

*20 or more responses

24.	Child-Made Materials	1
25.	Collage	1
26.	Color Books	2
27.	Colored Chalk	2
28.	Colored Circles	1
29.	Colored Cubes	5
30.	Colored Pens and Pencils	4
31.	Colored Tissue Paper	1
32.	Computer	1
33.	Constructive Playthings	1
34.	Copy Work	1
35.	Cornmeal Trays	1
36.	Crayons	2
37.	Creative Dramatics	1
38.	Criterion-Referenced Inventories	1
39.	Cycloteacher	5
40.	Daily Drill	1
41.	Denoff Program	1
42.	Developing Learning Readiness	2
43.	Developmental Skills Series Books (University City, Missouri)	1
44.	Diagnosis for Prevention	1
45.	Dig-a-jig	1
46.	Discovery Approach Techniques	1
47.	Ditto Masters	1
48.	Dr. Stott Series	1
49.	Drill Skill Sheets	1
50.	Drinking Straws	1

51	DUSO Kit for Self Development	5
52.	Easels	2
53.	Editorial Pictures	1
54.	Educational Activities Records	1
55.	Educational Progress Corporation	2
56.	Educational Publication Materials	1
57.	Educational Teaching Aids	1
58.	Educator's Publishing Service Materials	3
59.	Electric Drill Board (Teacher-Made)	1
60.	Electric Game Board (Teacher-Made)	1
61.	Electronic Question-Answer Machine	1
62.	Exercises	1
63.	Feed-In	1
64.	Felt Markers	2
65.	Field Trips	1
66.	Films, Filmstrips	13
67.	Finger Paint	3
68.	Finger Puppets	1
69.	Fish	1
70.	Flannel Boards	8
71.	Flashlight	2
72.	Flash Cards	1
73.	Flash-X	3
74.	Flex-Ed	1
75.	Folk Songs	1
76.	Folk Tales	1
77.	Follett Materials	3

78.	Foods (Like Potato Prints)	1
79.	Free Play	1
80.	Fuel Testing Program	1
81.	Getting Facts	1
82.	GI Joe Tracing Machine	1
83.	Glasser Circle	1
84.	GORT	1
85.	Graph Paper	1
86.	Group Learning Centers	1
87.	Hap Palmer Records	1
88.	Harcourt, Brace and Jovanovich, Inc.	1
89.	Harris Technique	1
90.	Hay-Wingo	1
91.	Home Movie Equipment	1
92.	Ideal Education (Moyer Vico Ltd.)	1
93.	Index Card File Boxes	1
94.	Individualized Instruction	3
95.	Instructional Aid Kits (Dexter and Westbrook)	1
96.	Instructo Flannel Board Materials	1
97.	Instructo Materials	1
98.	Interest Areas	1
99.	Kazoos	1
100.	Kitchen Timer	1
101.	LRS Techniques	1
102.	Label Maker	2
103.	Ladder	2
104.	*Language Master	57

*20 or more responses

105.	Large-Print Books	1
106.	Learning Center	1
107.	Learning and Doing (Houghton Mifflin)	1
108.	Learning Resource	1
109.	Legoes	1
110.	Leonard Series	1
111.	Let's Learn Sequence	1
112.	LIFE Program	2
113.	Life-Space Interviewing	1
114.	Lima Beans	1
115.	Lincoln Logs	1
116.	Lite-Brite	2
117.	Live Animals	1
118.	Long Brock String	1
119.	Looms	1
120.	Magic Squares (Educator's Publishing Service)	1
121.	Magazine Pictures	4
122.	Map and Globe Skills, Maps	3
123.	Masonite Board	1
124.	McCormick-Mather--Speedboat to Spaceship	1
125.	Memo Pad	1
126.	Metronome	5
127.	Milk Cartons	1
128.	Mouthwash	1
129.	Movie--Anyone Can	1
130.	Moving Targets	2
131.	Moving Wheels	1

132.	MPD	1
133.	MTA Scholar with Self-Made Programs	1
134.	Multisensory Materials	7
135.	Musical Instruments	1
136.	Needle and Thread Designs	1
137.	Neurodevelopmental Analysis	1
138	Newsprint	1
139.	Observation	1
140.	OEP Materials	1
141.	One-to-one Ratio	2
142.	Overhead Projector	8
143.	Paint, painting	4
144.	Painting Piano Keys	1
145.	PASS Slides	1
146.	Pasting	1
147.	Peanut Butter	1
148.	Plastic Egg Cartons	1
149.	Plastic Tubes (From Golf Clubs)	1
150.	Plastic Tubing Hoops	1
151.	Poker Chips	2
152.	Polaroid Photography	1
153.	Posters (With Uncluttered Backgrounds)	1
154.	Pots and Pans	1
155.	PREB	1
156.	Prescriptive Materials Retrieval System	1
157.	Prescriptive Teaching	5
158.	Printing Set	1

159.	Process Teaching	1
160.	Programmed Instruction	4
161.	PSLT	1
162.	Puppets	2
163.	Railroad Chalk	1
164.	Realia	1
165.	Records, Record Players	17
166.	Records, Sound Effect	1
167.	Red Cellophane	1
168.	Rescue and Spice	1
169.	Resource Guide for NWSEIMC	1
170.	Responsive Teaching Techniques	1
171.	Rhythm Instruments	1
172.	Rhythm Records	1
173.	Ritalin	1
174.	Role Playing Materials and Toys	2
175.	Rotator	4
176.	Rotoscope	1
177.	Rubber Band Board	1
178.	Rug	1
179.	Rulers	1
180.	Sand Timer	1
181.	SCIS	1
182.	Screening	1
183.	Seattle Program--Learning Disorders	1
184.	Shedd APSL	1
185.	Singing Sounds	1

186.	Sorriet Life	1
187.	SRA Map Series	1
188.	St. Louis Program	1
189.	Stamp Pads	1
190.	Stanchfield Materials	2
191.	Stereoscopes	1
192.	Student Desk-Sized Models	1
193.	Success-Oriented Programming	1
194.	Sugar	1
195.	SVE Filmstrips	2
196.	Systems 80	5
197.	*Tapes, Tape Recorders	55
198.	Tapes Unlimited	2
199.	Target Behavior	1
200.	Target Pasting	1
201.	Task Analysis	3
202.	Teacher Effectiveness Training	1
203.	*Teacher-Made Instructional Materials	40
204.	Teacher-Made Learning Stations	1
205.	Teacher-Made Tapes	2
206.	Teacher-Made Targets	1
207.	Teacher-Pupil Relationship	1
208.	Teaids	1
209.	TV Screen	1
210.	Threshold Program for Early Learners	2
211.	Time Lines	1
212.	Training Tasks	1

*20 or more responses

213.	Transparencies	3
214.	TRY: Experiences for young Children	1
215.	Tube	1
216.	Tutogram	1
217.	Typewriter (Keyboard Town-1)	19
218.	VMI Vanguard Program	2
219.	Vectogram Transparencies, Vectographic Material	2
220.	Videotape	1
221.	Wall Fixation Targets	1
222.	Water	1
223.	Water Painting	1
224.	Webster Materials	1
225.	Weston Woods Filmstrips and Tapes	2
226.	Who Said It	1
227.	Window Screen	1
228.	Words in Close	1
229.	Workbooks	2
230.	Workbook-Type Materials (Love Fearson)	1
231.	Workbooks (Finney and Company)	1
232.	Work Directly on Problem	1
233.	Zylophone	1
		575

Motor Training

Definition: Materials included under this heading are those which attempt to develop tracing ability, tactile sensitivity, body image, body orientation, balance, gross and fine motor coordination, or motor expression.

	Materials	Responses
1.	Angels in the Snow	2
2.	Auxter--Developmental Physical Training for Better Motor Functioning	1
3.	*Balance Beam, Balance Board, Balance Disc Walking Beam, Walking Board, Walking Rail	48
4.	Balls	14
5.	Barbells (Body Build)	1
6.	Barrels (Gross Motor Activities)	1
7.	Barsch Perceptual Motor Program	5
8.	Bat-N-Tap	1
9.	Batting Tee	1
10.	Beaded Letters and Numbers	2
11.	Bean Bags	10
12.	Body Concept Dittos	1
13.	Braley--Daily Sensorimotor Training Activities	1
14.	Clay, Clay Modeling	7
15.	Clay Pan	1
16.	Clay Ropes	1
17.	Climbing Towers	1
18.	Commercial Raised Letters	1
19.	Container (With Hole to Drop Objects Into)	1
20.	Cratty Perceptual Motor Activities	4
21.	Dances	1

*20 or more responses

22.	Dart Board	1
23.	Delacato Exercises	2
24.	Detect Tactile (SRA)	4
25.	Developmental Learning Materials	6
26.	Development of Basic Motor Skills (Alameda Co. School Department)	1
27.	Dexter Westbrook Boxes	1
28.	Dienes Blocks	1
29.	Directional-Spatial Pattern Board	1
30.	EDL System 100--Motility Training	1
31.	Feely Bags	1
32.	Felt Shapes	2
33.	Foot Mat (For Body Perception)	1
34.	Friedus Materials and Exercises	2
35.	Glow in the Dark Ball	1
36.	Gross Motor Equipment	2
37.	Gross Motor Games	4
38.	Gross Motor Program--ACLD Pamphlet from Canada	1
39.	Halsam Playtiles	1
40.	Harmon Bimanual Circles and Chalkboard	2
41.	Homemade Manipulative Materials	1
42.	Hopscotch	1
43.	Ideal Laterality, Directionality, Spatial Relations Dittos	3
44.	Jacks	3
45.	Jump Board	2
46.	Jump Ropes	12
47.	Jumping Jacks Exercises	1

48.	Jungle Gym	2
49.	Kane, Getman--Physiological Readiness Materials	2
50.	*Kephart Test and Program (Purdue Perceptual-Motor Survey)	51
51.	Kinesthetic Materials (Homemade)	1
52.	Kirschner Body Alphabet	1
53.	Laterality Dittos	1
54.	Line Walking	1
55.	Link Letters	1
56.	Lippincott Motor Program	1
57.	Manipulative Materials	3
58.	Marble Ramps	1
59.	Marsden Ball	3
60.	Match Sticks	1
61.	Matrix Board, Matrix Games	4
62.	Mats	2
63.	Mirror Activities	2
64.	Montessori Materials	8
65.	Motor Development Exercises--Hackett and Jensen	2
66.	Motor Development Equipment	3
67.	Move, Grow, and Learn--Frostig	4
68.	Movement, The First Step to Learning	1
69.	Musda Mosston--Developmental Movement	1
70.	Paddle Ball	1
71.	Physical Education Equipment	4
72.	Pick Up Sticks	1
73.	Pitchback Nets	1
74.	Play Dough	1

*20 or more responses

75.	Ring Toss Game	1
76.	Roller Skates	1
77.	Rolling Board	1
78.	Sand, Sand Boxes, Sand Trays	5
79.	Sandpaper Board, Sandpaper Letters and Numbers, Sandpaper Words	8
80.	Sand Tracing	2
81.	Scissors	3
82.	Scooter Boards	1
83.	Skateboards	1
84.	Skipping	1
85.	Slantboard	2
86.	Small Muscle Coordination Games	1
87.	Sponge Letters	1
88.	Spring Board, Spring-o-lene	3
89.	SRA Beginning to Learn Fine Motor Skills Kits	1
90.	Stepping Stones	1
91.	Stilts	1
92.	Suspendable Ball	1
93.	Suspended Balloons	1
94.	Swimming Exercises	2
95.	Swinging Ball	2
96.	Tactilemat	1
97.	Teeter Boards	1
98.	Textured Items	1
99.	The Big Shoe	1
100.	Three-Dimensional Letters	1
101.	Tin Can Stilts	1

102.	Tottie Bouncer	2
103.	Trampa, Trampoline	8
104.	Tunnel for Crawling	1
105.	Unifix Cubes	1
106.	Wooden Letters, Numbers	5
		328

Remedial Math

Definition: Materials included under this heading are those which provide drill and instruction on quantitative concepts, number facts, and arithmetic operations.

Materials	Responses
1. Abacus	5
2. Adding Machine	1
3. Addison-Wesley Math Program	3
4. A New Look at Fractions, Decimals, and Percentages (Continental Press)	1
5. Arithmetic Cubes: Math Aid (Scott Foresman)	1
6. Arithmestix	1
7. Bank Check Book Duplicates	1
8. Brauckner Math Test	1
9. Cash Register	1
10. Clock Faces	1
11. Coins	2
12. *Cuisinaire Rods	24
13. Discovery Mathematics	1
14. Distar Arithmetic	8
15. Dotted Numbers for Addition and Subtraction	1
16. Essential Modern Math Text (Ginn)	1
17. Fractions (Webster Publishers)	1
18. Fraction Discs	1
19. Fraction Pies	1
20. Handmade Fractional, Decimal, Percentage Wheels	1
21. Harper Row Pre-Number Readiness Lab and Books	1
22. Hays Modern Math	1

*20 or more responses

23.	Houghton Mifflin Math	2
24.	Imperial Cassette Programs in Math	1
25.	Income Tax Forms	1
26.	Individualized Math (Economy Company)	1
27.	IPI Math	2
28.	KTAV Math Materials	1
29.	Laidlaw Workbooks for Math	1
30.	Mastery Drills in Arithmetic (Hayes School Publishing Company)	1
31.	Math Balance Bar	1
32.	Math Flash Cards	1
33.	Math Mastery Tapes (Electronic Learning, Inc.)	1
34.	Math Materials	1
35.	Math Texts	1
36.	Math Workshop A, B, C, D	1
37.	Mathematical Balance	1
38.	Mathematics Skill Builder (Schultz)	1
39.	McGraw-Hill Math-Aero Practice Slate	1
40.	Measurement Containers	1
41.	Milton Bradley Arithmesticks	1
42.	Multiple Tracking, Math II	1
43.	Multiplication and Divide Charts	1
44.	Multiplication Win	1
45.	Multiplying Machine	1
46.	New Project Math (Cawley)	1
47.	Nine-Hole Math Pegs	1
48.	Nuffield Mathematics Series	1
49.	Number Lines	1

50.	Place Value Pockets (and Paper Strips)	1
51.	Play Money	1
52.	Plymouth Press Basic Fact Cards	1
53.	Pocket Computer	1
54.	Programmed Arithmetic	4
55.	Ready Arithmetic Review (Dana and Company)	1
56.	Roonie Numerals (Math Game)	1
57.	Self-Teaching Arithmetic	3
58.	Singer Programmed Math Series	6
59.	SRA Arithmetic Fact Kit	3
60.	SRA Greater Cleveland Mathematics	2
61.	SRA Manipulative Math Concepts	1
62.	SRA Mental Computation	2
63.	Steps to Mathematics (Steck-Vaughn Company)	1
64.	*Stern Structural Arithmetic	43
65.	Sullivan Programmed Math	12
66.	Teacher-Made Math Games	1
67.	Teaching Children Through Natural Mathematics (Dwyer)	1
68.	Teaching Resource Unifix Cubes for Math Concepts	1
69.	Timed Math Sheets	1
70.	Times Table Sheet	1
71.	Tuf (Math Game)	1
72.	Walk on Number Line	1
73.	Winning Touch (Math Game)	2
74.	Winston Math Series	2
75.	Working with Numbers (Stech-Vaughn Company)	2
76.	Zwieg Associates Diagnostic Skill Tapes in Math	1
		185

*20 or more responses

Remedial Reading

Definition: Materials included under this heading are those which provide drill and instruction on the alphabet, letter sounds, sound-symbol associations, word recognition, word attack skills, speed and fluency in oral and silent reading, and comprehension. Also included are alternative methods for teaching reading, high-interest low vocabulary materials, and content areas texts and supplementary books.

	Materials	Responses
1.	ABC Dictation Skills Program	1
2.	ABC Phonics Lab	1
3.	Alpha I Reading Method	4
4.	Alphabet Singo	1
5.	Alphabet Cards	1
6.	Alphabet Poster Cards (Milton Bradley)	1
7.	American Education Publication Newspaper, Know Your World	1
8.	American Heritage Picture Histories	1
9.	Atlas	1
10.	Audio Flashcard Reader (Electronics Futures, Inc.)	10
11.	Aurora Phonetic Sorting Board	1
12.	Bank Street Readers	1
13.	Barnell-Loft Series (Fun with Words--2 We Read Sentences--1 Specific Skill Series--4)	11
14.	Basal Texts	2
15.	Be A Better Reader Series	3
16.	Behavioral Research Reading Books	1
17.	Benefic Press Reading Series	1
18.	Bibs and Nicky Skilltext	1
19.	Book and Record Sets	1

20.	Bookmark Reading Program	1
21.	Books of Children's Poetry	1
22.	Botel Word Recognition	1
23.	Bowman Incentive Reading Series	4
24.	Bowman Records, Singing Sounds	1
25.	BRL Big Readiness Book	1
26.	Caroll--Programmed Phonics I and II	1
27.	Checkered Flag Series	4
28.	Code 78--Crane and Polk	2
29.	Codes to Captain Workbooks	1
30.	Color-Coded Method of Teaching	2
31.	Color-Cued Materials	2
32.	Configuration Clues	1
33.	Conquests in Reading	6
34.	Consonant Bingo	1
35.	Controlled Reader (Educational Development Lab)	9
36.	Cracking the Code (SRA)	3
37.	Dan Frontier Books and Records	2
38.	Dechant--Diagnosis and Remediation of Reading Disability	1
39.	Deep Sea Adventures	2
40.	Developmental Reading Materials	1
41.	Dictionaries	2
42.	Directional Phonics	1
43.	*Distar Reading Program	38
44.	Dolch Basic Sight Vocabulary Lists, and Word Cards	16
45.	Dolch Reading Program	4

*20 or more responses

46.	Dolch Word Games	5
47.	Dukane Projector and Reading Incentive Program	1
48.	Durrell-Murphy Phonics	3
49.	Easy Reader	1
50.	Economy Company Phonics and Reading Materials	6
51.	Electric Company	1
52.	Encyclopedias	1
53.	Educator's Publishing Service Tapes and Workbooks	1
54.	Educator's Publishing Service Phonetic Readers	1
55.	Educator's Publishing Service--Learning the Letters	1
56.	Exploring American History--Schwartz and O'Conner	1
57.	Fearon Pacemaker Series	2
58.	*Fernald VAKT Method	44
59.	Field Enterprise Reading Series	1
60.	Find the Right Word, Find the Right Letter, Fing the Right Number	1
61.	First Talking Alphabet	1
62.	Formula Phonics (Vail)	1
63.	Garrard Reading Program	1
64.	Gates Peardon Reading Series	4
65.	Geology Golden Press	1
66.	*Gillingham Reading, Gillingham-Stillman Reading, and Orton-Gillingham Reading	35
67,	Ginn Reading Series and Programs	14
68.	Go Fish Consonant Sounds Game	1
69.	Grolier Educational Reading Attainment System	1
70.	Hammond Color-Coded Blend Cards	1

*20 or more responses

71.	Harper Row Reading Series	6
72.	Harr Wagner Reading Program	3
73.	Hegge, Kirk, and Kirk Remedial Reading Drills	15
74.	Helson Phonics	2
75.	Heritage House Fairy Tales (Records and Books)	1
76.	Highlights Magazine	1
77.	High Interest, Low Vocabulary Books	1
78.	History Texts	1
79.	Hodkinson and Ornato--Wordly Wise	1
80.	Hoffman Reading Machines	5
81.	Holt Reading Series	2
82.	Houghton Mifflin Basal Series	2
83.	Houghton Mifflin Filmstrips and Records for Consonant and Vowel Sounds	1
84.	I Can Read Books	1
85.	I Can Do It (Mafex)	1
86.	Ideal Alphabet Practice Cards	1
87.	Ideal--Structured Reading Vowels	1
88.	Ideal Tapes for Sounds, Blends, Vowels, Consonants, Readiness	6
89.	Imperial Cassette Programs in Reading	2
90.	Individualized Phonics (Teachers Publishing Corporation)	1
91.	Individualized Reading	1
92.	i/t/a	2
93.	Jim Forest Readers	2
94.	Kinesthetic Alphabet (Hammetts)	1
95.	Laidlaw Linguistics Lab	1
96.	Landon Phonics	1

97.	*Language Experience Approach, Charts, Stories	25
98.	Language Patterns Reading Series (Holt)	2
99.	Language Stories and Drills (Varmant Printing Company)	1
100.	Let's Read--Bloomfield	9
101.	Letter Cards	1
102.	Letter-Sound Relationship Material	2
103.	Library Books	1
104.	Lift-Off to Reading Series	1
105.	Linguistic Approach to Reading	5
106.	Lippincott Reading Series	7
107.	Listen My Children (B.L. Kratoville)	1
108.	Living Things (Benefic Press)	1
109.	Loud on Phonics (Scholastic)	2
110.	Louisville Courier Journal	1
111.	Lulu Comics	1
112.	Lyons and Carnahan Reading Series	4
113.	MacMillan Reading Series	5
114.	Magazines	3
115.	Magnetic Letters	1
116.	McCall Crabbs Test and Reading Series	6
117.	McGraw-Hill Programmed Reading	1
118.	McGraw-Hill Step Up Your Reading Power	1
119.	McKee Reading for Meaning	1
120.	Merrill Reading Programs	5
121.	*Merrill Linguistic Series	22
122.	Metropolitan Readiness Test	1
123.	Miami Linguistic Readers	5

*20 or more responses

124.	Milliken Materials	2
125.	Milton Bradley--Short Vowels	2
126.	Modern Curriculum Press Phonics	1
127.	Modified Basal (DRTA)	1
128.	Modified Fernald Trace Method	1
129.	Modified Gillingham	1
130.	Modified Phonic Texts	1
131.	Modified Teaching Alphabet	1
132.	Molt Comprehension Series	1
133.	Monroe--Basic Reading Skills	2
134.	Morgan Bay Mysteries	1
135.	Motor Trend	1
136.	National Geographic	1
137.	NEA Journal Unfinished Stories	1
138.	Neurological Impress Method	6
139.	New Diagnostic Reading Workbook Series (Merrill)	1
140.	New Practice Readers	5
141.	Newspapers	5
142.	Open Court Reading Series and Breaking the Code	11
143.	Organic Word Boxes (from Ashton Warner)	1
144.	Organizational Equipment in Reading Remediation	1
145.	Owl Series	1
146.	Pacer Machine and Pacerecorders (Economy Company)	2
147.	Palo Alto Reading Program	9
148.	Parkinson Readiness Workbooks	1
149.	Peabody Rebus Reading Program	17
150.	*Phonetic Approach to Reading	34

*20 or more responses

151.	Phonetic Drill Cards	1
152.	Phonetic Word Blend Flip Cards	1
153.	Phonics We Use (Lyons and Carnahan)	13
154.	Phonovisual Materials	17
155.	Pirate Keys to Reading Game	1
156.	Playskool Magnetic Capital Letters	1
157.	Popular Mechanics Magazine	1
158.	Portable Sound Chart	1
159.	Primary Phonics	1
160.	Pro Reading Series	1
161.	Programmed Reading	9
162.	Project Read	2
163.	Psychotechnic Discovering the Alphabet	1
164.	Radio Reading Series	1
165.	Random House Books	1
166.	Read, Study, and Think	1
167.	Read-the-Picture Stories	1
168.	Reader's Digest Reading Series	13
169.	Reading Attainment Series	1
170.	Reading and Language	1
171.	Reading Comprehension	1
172.	Reading for Concepts, Reading for Meaning, Reading for Understanding	7
173.	Reading Helper Series	1
174.	Reading Machine	1
175.	Reading Time Books	1
176.	Reading Train Chart and Reward System	1
177.	Reading Progress Lab	1

178.	Reading and Thinking Skills (Continental Press)	4
179.	RFU Kit	3
180.	Reversal Program	1
181.	Royal Road to Reading Series	1
182.	Safari Series	1
183.	Scanning Programs	4
184.	Scholastic Publications	1
185.	Science Experiment Books	1
186.	Scott Foresman Reading Programs (Open Highways Readers--5)	13
187.	Sight and Sound Readers	1
188.	Singing Method of Teaching Reading	1
189.	Skill Paces and Read-On	1
190.	Slingerland Test and Techniques	12
191.	Sounds and Stories	1
192.	Sounds of Language	1
193.	Sound Way to Easy Reading	2
194.	Spache Reading Scales	1
195.	Spectrum Series	1
196.	Speech to Print Phonics	1
197.	SRA Linguistic Programs	6
198.*	SRA Reading Programs	56
199.	Standard Reading Series	1
200.	Stanford Achievement Test	1
201.	Stanwix House Readers	2
202.	Steck-Vaughn Readers	2
203.	Stereo Reader	2

*20 or more responses

204.	Stern Structural Reading	7
205.	Stories	1
206.	*Sullivan Programmed Reading Program	59
207.	Tach-X, Tachistoscope	19
208.	Teacher-Made Reading Materials	3
209.	Try Phonics Program	6
210.	Typing Keys for Remediation of Reading	3
211.	Vowel and Consonant Blend Cards	1
212.	Vowel Bean Bags	1
213.	Webster Reading Programs	6
214.	Weekly Reader Materials	3
215.	Wildlife Adventure Series	1
216.	Wollensak Phonics Tapes	2
217.	World Book	1
218.	World Traveler Series	1
219.	You and Your World Newspaper	1
220.	Zweigh Associates Diagnostic Skill Tapes in Reading	1
221.	Zweig Associates Word Lists	1
		890

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*20 or more responses

Social Skills

Definition: Materials included under this heading are those which teach courtesy, safety, vocational attitudes, or self concept.

	Materials	Responses
1.	Caine Levine Rating Scale for Social Skills	1
2.	Developing Understanding of Self and Others	2
3.	Home Guidance Programs	1
4.	Human Development Program	1
5.	SRA Self-Concept Materials	1
		6

Spelling

Definition: Materials included under this heading are those which are specifically named as spelling programs.

	Materials	Responses
1.	Behavioral Research Spelling	1
2.	Botel Spelling List	2
3.	Dictating Simple Words Using Phonic Skills	1
4.	Dr. Spello (Webster, McGraw-Hill)	5
5.	EDL Spelling Program for Tach-X	2
6.	Key Spelling Lab	2
7.	Lyons and Carnahan Spelling	2
8.	Merrill Spelling Workbooks	1
9.	Orton-Gillingham Spelling	1
10.	Plankett--Spelling Workbook	1
11.	Rak--The Spell of Words	1
12.	Reading Roads to Spelling	1
13.	Space Age Spelling with Tapes	1
14.	Spalding Phonograms and Spelling Rules	1
15.	Spelling and Writing Patterns	1
16.	Spelling Books	1
17.	Spelling Generalizations	1
18.	Spelling Lists	2
19.	Spelling Program	1
20.	Spelling Workbooks	2
21.	Spill and Spell	1
22.	Stern Spellers (Singer)	1
23.	Systematic Spelling (Williams)	1

24.	Teacher-Written Spelling Lists	1
25.	Typing Keys for Remediation of Spelling	1
		35

Thinking Skills

Definition: Materials included under this heading are those which teach concepts, associations, classification, sequencing, or problem solving.

	Materials	Responses
1.	Action Kit	1
2.	Action Songs (For Sequencing)	1
3.	Association Cards	2
4.	Attribute Games	5
5.	Categorization Cards (DLM)	1
6.	Classification Game	1
7.	Cognitive Thinking	1
8.	Continental Press--Thinking Skills	2
9.	ESS Attribute Blocks	1
10.	Inquisitive Games	1
11.	McGraw-Hill Attribute Materials	1
12.	McGraw-Hill Concept Plaques	1
13.	Muffin Tins (sorting)	1
14.	Organizational Materials	1
15.	Piaget Curriculum--Lavatelli	4
16.	Quess Conceptual, Sequence, and Memory Materials	1
17.	Sequence Patterning	1
18.	Sequence Stories (DLM)	1
19.	Sequencing Materials	1
20.	Sequential Pictures	2
21.	Size Sequencing Toys	1
22.	SRA Inquiry Box	1
23.	SRA Learning to Think Series	6

24.	The Thinking Box	1
25.	Thurstone Learning to Think Series	1
26.	What's Wrong Discussions	1
		41

Visual Perception

Definition: Materials included under this heading are those which use visually-presented material and which attempt to train visual discrimination, visual memory, visual closure, speed of perception, or other visual abilities. Also included are visual-motor training programs.

Materials	Responses
1. Anaglyph Material, Anaglyph Glasses	2
2. Ayres Test and Perceptual Program	6
3. Beads, Beads and String, Bead Designs	6
4. Beery and Buktenica Test and Program (Developmental Test of Visual Motor Integration)	4
5. Block Designs, Block Patterns	7
6. Bruno--Seeing Skills (Filmstrips)	1
7. Cheves Perceptual Program	1
8. *Continental Press Materials	26
9. Design Cards, Geometric Figure Cards	4
10. *Developmental Learning Materials	40
11. Developmental Vision--Dr. Pepper	1
12. Dot-To-Dot	2
13. *Dubnoff School Program	22
14. ERIE Perceptual Program	9
15. Eye-Motor Exercises	1
16. Fairbanks Robinson Program	9
17. Fitzhugh Plus Program	10
18. *Frostig Test and Program (Developmental Test of Visual Perception)	118
19. *Getman Programs and Materials	20
20. Ideal Perceptual Materials	6
21. Lenses, Lens Therapy	6

*20 or more responses

22.	Lippincott Visual-Motor Readiness for Learning	1
23.	Look, Mark, and Say	1
24.	Manual of Primary Perceptual Training	1
25.	Match and Check Set	1
26.	Matching Designs, Matching Objects	2
27.	*Michigan Tracking Program	34
28.	MKM Tracking Materials	1
29.	N.Y. Times Sequential Perceptual Motor Exercises	1
30.	Ocular Tracking	1
31.	Optometric Extension Program	1
32.	*Parquetry	29
33.	Pathway School Program	4
34.	Peabody Perceptual Training Book	1
35.	*Pegboards, Pegboard Designs	36
36.	Percept-o-matic	1
37.	Perceptual Activities	3
38.	Perceptual Plaques	1
39.	Perceptual Remediation, Inc.	1
40.	Perceptual Skills Kit	1
41.	Perceptual Skills Game	1
42.	Playskool Matchups	1
43.	Prisms	1
44.	*Puzzles (Geometric Puzzles--1 Gotkin Puzzles--1 Jigsaw Puzzles--1 Judy Company Puzzles--3 Kaleidoscope Puzzles from Ideal Parquetry Designs--1 Puzzles--23 Pyramid Puzzles--1 Ruth Chenes Puzzles--1	32

*20 or more responses

45.	Rappaport Techniques	1
46.	Russell Perceptual Sorting Kit	3
47.	Society for Visual Education	1
48.	Spatial Relation Picture Cards	1
49.	Stencils	2
50.	Stimulus Reduction of Visual Materials	1
51.	Tangrams	3
52.	Teacher-Made Visual Materials	1
53.	*Teaching Resources Visual Materials	21
54.	Telebinocular	1
55.	Templates, Template Training	9
56.	Tracking	3
57.	Van Witsen--Perceptual Training Activities Handbook (Teachers College, Columbia University	4
58.	Visual-Auditory Sequence Training	1
59.	Visual Memory Programs and Cards	4
60.	Visual-Motor Program--Darrell B. Harmon	1
61.	Visual-Motor Program--Dr. Bruce Wolff	1
62.	Visual-Motor and Perception Manipulative Materials	1
63.	Visual Perception Skills Filmstrips	1
64.	Visual Perception Training	4
65.	Visual Tutors	1
66.	Webster Eye and Ear Fun	1
67.	Winterhaven Test and Materials	12
		535

*20 or more responses

Writing

Definition: Materials included under this heading are those which teach letter formation and penmanship.

	Materials	Responses
1.	Air Writing	1
2.	Cursive Alphabet (in Colored Chalk)	1
3.	Cursive Alphabet Tracing Board	1
4.	Cursive Writing (and Simultaneous Talking)	1
5.	DLM Cursive Writing Paper	1
6.	Embossed Pencil Writing Paper (American Foundation for the Blind Printing House)	1
7.	First Activities in Composition	1
8.	Johnson Handwriting	1
9.	Kleeko--Practice Writing Books	1
10.	KTAV Writing Materials	1
11.	Look and Write	2
12.	Magic Slate and Soft Point Stylus	1
13.	Magnetic Wrist Holder and Board	1
14.	Modified Cursive Letter Forms (Colored Coded)	1
15.	Patterned Writing Materials	1
16.	Practice Writing Series	1
17.	Rice Writing with Fingers	1
18.	Salt Box Writing, Salt Writing with Fingers	2
19.	Sand Writing with Fingers	1
20.	Seale--I Learn to Write	1
21.	Sloped Writing Surfaces	1
22.	Special Writing Paper	1
23.	SRA Penskill	2

24.	Structured Paper	1
25.	Trac-a-bit Writing Cards	2
26.	Tracing	5
27.	Water tracing on Slate	1
28.	Write and See (Lyons and Carnahan)	7
29.	Writing Boards	1
30.	Writing Ditto Sheets	1
31.	Writing Skills Lab	1
32.	Zaner-Bloser Finger Grip Pencils	1
33.	Zaner-Bloser Handwriting	2
		48

APPENDIX S

DATA FROM DCLD SURVEY OF PROBLEMS

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The DCLD responses to the incomplete statement, "Typical problems for which I use the above materials and techniques are. . .," are presented in this appendix according to 13 problem groupings in rank order of decreasing frequency of responses. These groupings are: auditory perception problems, visual perception problems, reading and phonics problems, motor problems, general learning disabilities problems, language development problems, math problems, attitudinal and emotional problems, thinking problems, spelling problems, other handicaps, social skills problems, and writing problems.

Auditory Perception Problems	Responses
1. auditory perception problems	49
2. auditory difficulties	48
3. auditory discrimination problems	48
4. auditory memory problems	48
5. sound blending difficulties	18
6. auditory sequencing	17
7. listening comprehension problems	13
8. auditory receptive and expressive disorders	3
9. auditory decoding	2
10. auditory-motor integration problems	2
11. auditory attention	1
12. auditory encoding	1
13. auditory fusion and closure problems	1
14. auditory language problems	1
15. auditory-vocal difficulties	1

Visual Perception Problems	
1. visual perception	61
2. visual memory problems	56
3. visual difficulties	40
4. visual discrimination problems	31
5. figure-ground difficulties	19

6. visual sequencing	17
7. ocular problems	2
8. strabismus	2
9. visual integration	2
10. visual reception problems	2
11. accomodation	1
12. eye-tracking problem	1
13. visual input	1
14. visual vocal integration problems	1

Reading & Phonics Problems

1. reading difficulties	109
2. reversals and inversions	26
3. directional difficulties	25
4. comprehension problems	14
5. specific skill difficulties	14
6. dyslexic	13
7. non-readers	12
8. sound-symbol problems	10
9. decoding problems	5
10. rate problems	1
11. oral reading problems	1
12. word recognition problems	1

Motor Problems

1. visual-motor difficulties	65
2. motor problems	60
3. directional difficulties	25

4.	spatial relationship problems	25
5.	perceptual motor difficulties	19
6.	incoordination	12
7.	kinesthetic-tactile problems	6
8.	laterality problems	6
9.	body image	3
10.	sensory-motor problems	2
11.	intersensory integration	1
12.	neuromuscular problems	1
13.	psychomotor problems	1
14.	tactile-motor problems	1

General Learning-disabilities Problems

1.	perceptual difficulties	50
2.	attention deficits	30
3.	learning-disabilities children	19
4.	hyperacticity	19
5.	memory problems	19
6.	low academic achievement	14
7.	distractibility	8
8.	learning problems	6
9.	neurological organization difficulties	4
10.	perseveration	4
11.	non-verbal problems	2
12.	automatic skill deficits	1
13.	central processing difficulties	1
14.	musical disabilities	1

Language Development Problems

1.	language problems	76
2.	vocabulary difficulties	19
3.	oral expression problems	18
4.	verbal communication problems	12
5.	oral reception problems	9
6.	speech problems	6
7.	grammar problems	5
8.	psycholinguistic problems	4
9.	articulation problems	3
10.	rhyming difficulties	3
11.	apraxia	2
12.	word meaning	2
13.	aphasia	1
14.	dysphasia	1
15.	encoding process disabilities	1
16.	English skills	1
17.	symbolic disorders	1
18.	word patterns	1

Math Problems

1.	arithmetic difficulties	73
2.	dyscalculia	5
3.	quantitative problems	1

Attitudinal and Emotional Problems

1.	low self concepts	22
2.	motivational problems	20

3.	emotional problems	16
4.	attitudinal problems	2
5.	withdrawn	2
6.	adjustment problems	1
7.	nervous	1

Thinking Problems

1.	sequencing problems	26
2.	conceptual problems	23
3.	reasoning problems	8
4.	cognitive deficits	2
5.	organization problems	2
6.	part-whole relationship problems	1

Spelling Problems

1.	spelling difficulties	36

Other Handicaps

1.	educable mentally retarded	5
2.	other handicaps	5
3.	brain-damaged	4
4.	slow learners	4
5.	mentally retarded	4
6.	culturally deprived	3
7.	cerebral palsy	2
8.	educationally handicapped	2
9.	allergies	1
10.	deaf	1
11.	educable mental handicapped	1

12. epileptic	1
13. trainable mentally retarded	1
Social Skill Problems	
1. behavior problems	20
2. social misperception	12
Writing Problems	
1. writing problems	26
2. dysgraphia	3
3. non-writers	1
4. topographic disorders	1